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HumRRO

Final Report

FR-CD(D)-75-3

Training Programs for the Synthetic Flight Training System

Oran B. Jolley, Robert N. Isley, and Edward J. Miller

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street • Alexandria, Virginia 22314

Approved for public release; distribution unlimited.

June 1975

Prepared for

U.S. Army Research Institute for the
Behavioral and Social Sciences
1300 Wilson Boulevard
Arlington, Virginia 22209

The findings, guidelines, and assumptions of this report are not to be construed as an official Department of the Army acceptance or position. The Army Research Institute for the Behavioral and Social Sciences caution the reader that the techniques described herein have not, as yet, undergone adequate evaluation. The contents of the report reflect the views of the Human Resources Research Organization which is responsible for the accuracy and completeness of the material thus far presented. The report does not necessarily reflect the opinion of the U.S. Army Aviation Center.

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This report describes a proposed experimental program of instruction for Army undergraduate flight training. The program was designed to capitalize on the advanced training features of Device 2B24, the first subsystem of the Army's Synthetic Flight Training System (SFTS). In the proposed program, the device, which simulated the UH-1 helicopter, would be used as one of the Army's primary flight training vehicles. Training material and notes on program administration are described. The report also includes

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20. Continued...

a discussion of the present status of the automated training program feature of Device 2B24.

The training program described in the report has not been subjected to a full-scale evaluation. Portions of the program were tested, using HumRRO and U.S. Army volunteers, and was found suitable for further use. The draft training materials developed for this program are documented in this report in the event an evaluation of the program is undertaken in the future.

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FINAL REPORT

Training Programs for the Synthetic Flight Training System

by

Oran B. Jolley, Robert N. Isley, and Edward J. Miller

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Work Unit SYNTRAIN

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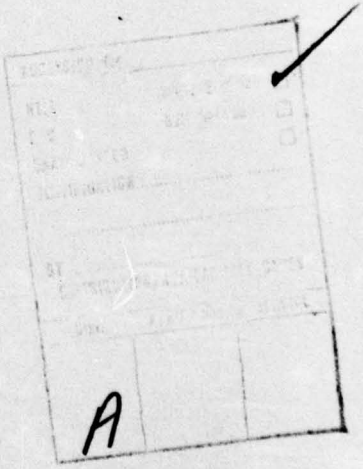

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FOREWORD

This Final Report by the Human Resources Research Organization summarizes final projects of Work Unit SYNTRAIN performed for the U. S. Army Research Institute for the Behavioral and Social Sciences. The purpose of Work Unit SYNTRAIN has been to expedite the application of advances in training technology to the design and utilization of Army aviation synthetic training equipment.

Conducted at Fort Rucker, Alabama, by the HumRRO Central Division, Work Unit SYNTRAIN began in 1968 and is terminated with the publication of this report. Principal SYNTRAIN reports are Technical Report 70-10, *Device-Task Fidelity and Transfer of Training: Aircraft Cockpit Procedures Training*; Technical Report 72-11, *Determining Training Device Requirements in Fixed Wing Aviator Training*; Technical Report 73-20, *Research on Synthetic Training: Device Evaluation and Training Program Development;* and Technical Report 75-12, *Mission Suitability Testing of an Aircraft Simulator.*

Mr. Robert N. Isley served as Principal Investigator during the last year of the SYNTRAIN effort. In addition to the authors, a number of HumRRO personnel, both past and present, have made significant contributions to the research reported here. The efforts of Dr. Paul W. Caro, Simulation Programs Manager for HumRRO and the initial Principal Investigator for SYNTRAIN, Dr. Melvin D. Montemerlo, Mr. Eugene R. Hall, Dr. John L. Bilbrey, Jr., Mr. Maurice Siskel, Jr., and Mr. Winon E. Corley were particularly helpful.

Military support for Work Unit SYNTRAIN was provided by the U. S. Army Research Institute Human Research Unit, Fort Rucker, Alabama.

LTC Donald E. Youngpeter was Unit Chief during the period covered by this report.

HumRRO research for the Department of the Army is conducted under Contract No. DAHC 19-73-C-0004. Army training research is performed under Army Project No. 2Q764715A757. The Contracting Officer's Technical Representative for Contract No. DAHC 19-73-C-0004 is Dr. Arthur J. Drucker.

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Chapter 1

INTRODUCTION

BACKGROUND

Work Unit SYNTRAIN, Modernization of Synthetic Training in Army Aviation, was initiated in 1968 to expedite the application of advances in training technology to the design and utilization of Army aviation synthetic training equipment through surveys of training device design requirements and technology and by human factors and training research. Major aspects of the Work Unit have already been reported in the following technical reports: *Device Task Fidelity and Transfer of Training: Aircraft Cockpit Procedures Training*; *Determining Training Device Requirements in Fixed Wing Aviator Training*; *Research on Synthetic Training: Device Evaluation and Training Program Development*; and *Mission Suitability Testing of an Aircraft Simulator.*[1]

The last report cited above dealt with the results of an operational suitability test of the Army's simulator for the UH-1H aircraft, Device 2B24. Device 2B24 is the first subsystem of a series of flight simulators, collectively called the Synthetic Flight Training System (SFTS), envisioned for the Army (subsystems for the CH-47C, Device 2B31, and the AH-1Q, Device 2B33, are currently in procurement[2]). The operational

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[1] A complete listing of Work Unit SYNTRAIN publications and research by-products is given in Appendix A.

[2] HumRRO has been involved in the design and development of both these subsystems since their conception, and both will have several advanced design-for-training features intended to enhance their training value. Advanced features that will require testing and evaluation include: (a) automated maneuver demonstration systems; (b) sling load training system; (c) weapons firing and scoring system; (d) visual transition flight training capability, and (e) pilot and gunner flight instructor stations.

suitability test of Device 2B24 was conducted to evaluate the device's potential for cost-effectively accomplishing the instrument phase of Army rotary wing flight training and facilitating UH-1 transition training, aviator proficiency evaluation, standardization, and flight training quality control. Test results confirmed the device's mission suitability regarding both cost-effectiveness and transfer of training (1, 2, 3). Forty-three hours of simulator time and approximately 6 hours of aircraft time were substituted for 60 hours of aircraft and 26 hours of training device time, with no degradation of student pilot performance. The Army obtained similar results in a subsequent test of the training value of Device 2B24 (4). The 2B24 is currently being used routinely to support the instrument flight training phase of the undergraduate flight training program, the Rotary Wing Qualification Course, the Rotary Wing Instrument Course, the Rotary Wing Instrument Flight Examiner Course, and proficiency training for faculty and staff at the Aviation Center.

Having established Device 2B24's capability of fulfilling its training mission at considerable cost savings, attention turned to two areas of research: (a) examination of the automated training program features of the device which were not fully assessed during the suitability test, and (b) development of a training program to enable more extensive utilization of the 2B24 with undergraduate trainees. Earlier test findings had indicated that the device's design was such that even greater potential utilization might be achieved in the undergraduate flight training program (3).

DEVICE 2B24 AUTOMATED TRAINING PROGRAMS

The developmental nature of the 2B24 automated training programs supplied by the manufacturer and the problems associated with their use have been discussed in some detail in the report of the operational suitability test cited earlier (1, 2). Essentially, the automated training exercises developed for Device 2B24 are analogous to computer-administered instruction (CAI) programs, in that a number of revisions are typically required before they can be considered appropriate for routine training use. The suitability test results indicated that, while considerable additional developmental effort would be required in this area, such effort not only would likely enhance the device's training effectiveness, but also would add to the technology of automated training. Consequently, these developmental efforts were continued, on a time-available basis, in cooperation with the Army's device programing staff. These efforts and the present status of the automated training programs are discussed in Chapter 2.

FURTHER UTILIZATION OF DEVICE 2B24

Beginning in 1973, research activities were undertaken by HumRRO to design and evaluate a training program that would maximize Device 2B24's potential contribution to undergraduate flight training. The resulting experimental training program, designed to replace the undergraduate flight training program currently in use, is conceptually and administratively different from the traditional approach to undergraduate flight training. The procedures involved in its design were similar to those employed in earlier HumRRO research (5, 6), in which certain methods

and techniques were added, dropped, or extensitvely modified during the program's evolution.

Unlike those previous developmental efforts, however, a step vital in the development of any successful training program was not performed: program testing. This step is essential to enable program refinement and evaluation, but was not possible to accomplish during the time available due to other activities at the Aviation Center. Therefore, even though portions of the experimental training program were tried out by HumRRO personnel and Army volunteers, it is by no means complete, and is described here only as the basis for future development.

In addition, a number of administrative and/or policy decisions concerning the program have not been addressed. Major among these are the extent of the requirements for solo flight in the UH-1 and the possible need for revisions to both academic and in-flight examinations to make course administration more efficient. Had the proposed test of the new program been carried out, guidance for making these decisions would have been developed.

Discussion of the experimental training program appears in Chapter 3.

Chapter 2

AUTOMATED TRAINING PROGRAMS

Device 2B24 represents the first major acquisition of state of-the-art helicopter flight simulators for the U. S. Army. Incorporated into the device are the latest concepts in training device design and training technology. The main concept that distinguishes the 2B24 from existing systems is that of automated training. The manufacturer delivered the device with developmental programs capable of demonstrating the automated training functions of the device. These programs were not intended to be a complete, ready-to-use training program. Ten sample programs were available at delivery, including Basic Instruments, Instrument Takeoff, ADF Approach, VOR Approach, ILS Approach, Holding, Back Course ILS Approach, a Cross-Country Flight, and In-Flight Engine Restart, and an Instrument Checkride.

The ten programs included such features as (a) demonstrations of maneuvers and procedures; (b) programed instructional periods containing automatic briefings, computer-controlled demonstrations, guided practice segments with performance monitoring, and adaptive training segments in which the difficulty level of the task being performed by the student is automatically adapted to the skill level or performance level of the student; and (c) an automated checkride with performance monitoring and a hard-copy printout of all out-of-tolerance conditions. In addition, the device provides a capability for the processing of training data for quality control purposes.

During the operational suitability test, conducted as an integral part of the Expanded Service Test, the automated training features were

examined, and a great deal of useful information was obtained. Unfortunately, the programs were unusable in their existing condition. Due to the relatively long lead time necessary to correct the problems associated with the automatic features and the press of other suitability test activities, further testing and analysis of these automatic features were postponed. After completion of the test and relocation of the device to a permanent facility, the Aviation Center demand for operational training time in the device precluded any further systematic automatic program testing and evaluation. The Center did, as time permitted, analyze, edit, and re-record each automatic briefing. Software modifications were also made to standardize maneuver and procedure demonstrations.

With the receipt of additional devices at Fort Rucker, more time was available for examination of programs and correction of obvious errors and software problems. HumRRO activities were coordinated with responsible personnel from the Flight Simulator Division of the Aviation Center, and a continuous exchange of findings and results ensued. Many problems were encountered which initially made it impossible to complete all the programs. For example, one problem was identified as the need for an adjustment to the tone level on the tape recorder which would cause the tapes and computer to get out of synchronization, totally negating use of the automated programs. Just recently, a procedure was discovered which virtually eliminates this problem. In their present condition, the automated training programs are usable, the audio content is technically correct, and the maneuver demonstrations are procedurally correct. Performance recording printouts, however, are unusable.

HumRRO personnel examined in detail each of the ten automated programs. Based on the findings of this examination, portions of the programs were tried out on fixed wing qualified, non-instrument rated volunteers, and also on several individuals with no flight experience, during the presentation of helicopter instrument instruction to them. The programs were used to provide demonstrations of specific maneuvers at the appropriate time in the training program, and were also used to provide guided individual practice and periods of adaptive training. For the most part, an instructor was present to determine when to introduce the automated program and provide supplemental instructions to clarify program objectives. Occasionally, students were provided training time in the automated mode without an instructor in the cockpit and then were subsequently required to demonstrate their skills and knowledges acquired in this fashion to an instructor. Thus, at the present time the automated programs could be a useful tool for qualified instructors trained to use them. They are not, however, considered ready for routine training use without additional refinement and testing, without which their use by students and instructors would likely be haphazard. Likewise, the absence of refinement and evaluation precluded the planned incorporation of one or more of the automated training programs into the experimental training program described in the next chapter of this report.

Some of the expected benefits from the use of the automated programs are: (a) they perform many of the routine (repetitive) operations heretofore assigned to the human instructor, freeing him for other instructional tasks; (b) they provide a means of presenting standardized

maneuvers and procedures to all students; (c) they have the capability to provide objective measures of deviations on selected parameters of pilot and aircraft performance from a specified standard; and (d) they have the capability to provide quality control through standardization of Army instrument training programs and to identify areas of non-standard performance by individuals and units.

Because of the contribution these programs could make to standardization of training, both at the Aviation Center and at field locations, a research program to continue the previous developmental efforts would appear warranted. Until such time as the automated training programs are formally tested, their training effectiveness remains unknown.

Chapter 3

THE EXPERIMENTAL TRAINING PROGRAM

RATIONALE

The purpose of the Primary Phase of undergraduate flight training is to enable the student to learn the psychomotor skills necessary to control the attitude of the aircraft in flight, takeoff, landing, and visual navigation. Traditionally, this has been accomplished using the real world as an attitude reference (contact flying). The sequence generally followed in flight training has been (a) day contact flight, (b) night contact flight, and (c) instrument flight. Control manipulation to achieve a desired aircraft attitude, however, is the same, regardless of the cue used, contact or instrument.

As early as the 1930s, the efficacy of the traditional sequence was challenged in an experiment where instruments were taught first (7). This and later studies produced evidence that there is *positive* transfer of training when instrument flight training is conducted first, followed by contact training, and *negative* transfer of training when the usual sequence is followed (8, 9, 10). Another form of instruction, known as integrated training--training in which the student is required to learn to perform a maneuver using instrument cues prior to learning it using contact cues during a common flight period--is used by the U. S. Air Force in undergraduate flight training and has been alluded to by the FAA in its private pilot requirements (11, 12).

Based upon prior research and the practices of other training groups, it was hypothesized that Device 2B24 could be used to teach the

beginning student initial flight control skills before he goes to the aircraft, and that such training would facilitate the subsequent learning of contact flight skills. This expectation is testable, and the program of instruction described below was developed for use in a test of this hypothesis.

OVERVIEW

To provide a frame of reference for the discussion of the experimental training program, a brief description of the current program is provided.

Current Undergraduate Flight Training Program

The Officer/Warrant Officer Rotary Wing Aviator Courses (O/WORWAC) at the U. S. Army Aviation Center graduate approximately 90 aviators each month. The split between officers and warrant officer candidates (WOCs) is approximately 50-50, and the courses are identical except that the WOC receives two additional weeks of preflight training, designed to help prepare him to assume the responsibilities of a U. S. Army warrant officer.

The courses are conducted in two phases. Phase I lasts 12 weeks, during which the trainees receive 85 hours of dual flight instruction and solo practice in the TH-55 helicopter. All of this training is conducted in accordance with Visual Flight Rules (VFR), with aircraft control being maintained by reference to real world cues. In addition, the trainee receives 98 hours of academic instruction. Phase I training, both flight and academic, is conducted by a civilian contractor.

Upon successful completion of Phase I, the trainee begins Phase II training, which lasts 20 weeks and is conducted in two parts: instrument flight training and advanced contact flight training. During the instrument portion of training, the trainee learns to fly the UH-1 helicopter solely by reference to cockpit instruments in accordance with Instrument Flight Rules (IFR) as specified in Army Regulations 95-1. Training is conducted in the 2C35 cockpit procedures trainer (4 hours), Device 2B24 (20 hours), and the UH-1 aircraft (30 hours). Advanced contact flight training consists of qualification (20 hours) and tactical flight training (45 hours) in the UH-1 aircraft. During Phase II training, trainees also receive 285 hours of academic instruction designed to support this phase of flight training. All Phase II training is conducted by military or Department of the Army civilian personnel.[1]

A flow chart of current undergraduate flight training is shown in Figure 1.

The Experimental Training Program

In contrast to the current undergraduate flight training program described above, the experimental program proposes to replace the Primary Phase of training in the TH-55 helicopter with training in Device 2C35, Device 2B24, and the UH-1 aircraft. Students would receive training in

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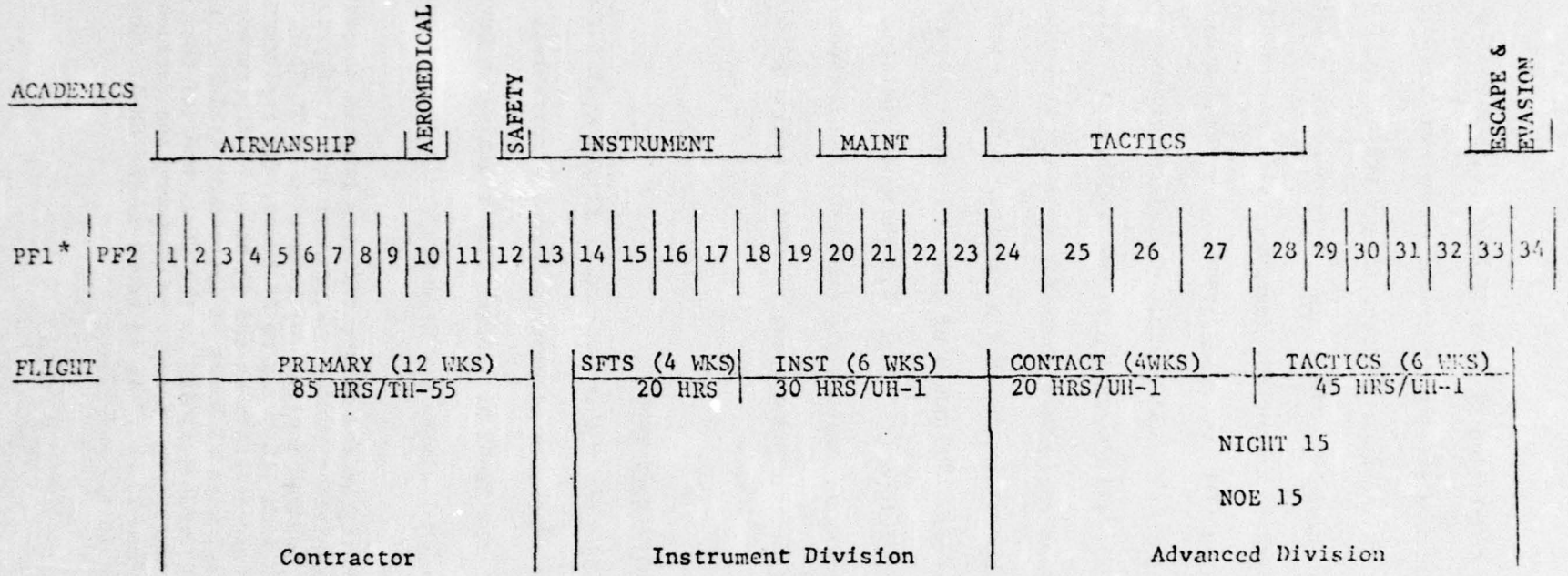
[1]The current undergraduate flight training program described above has evolved since completion of the operational suitability test of Device 2B24. Major changes include (a) reduction of TH-55 training time in the Primary Phase from 110 hours to 85 hours, (b) replacement of 60 hours of TH-13T instrument training and 26 hours of instrument procedural training in the 1-CA-1 with 20 hours of instrument training in the 2B24 and 30 hours of instrument training in the UH-1, and (c) UH-1 advanced contact training reduced from 25 hours to 20 hours and tactical flight training increased from 25 hours to 45 hours in the UH-1. The earlier program is described in (1) and (2).

Figure 1

Current Undergraduate Flight Training Flow



*WOCs have 4 wecks preflight

aircraft control techniques, UH-1 operating procedures, and instrument flight procedures in the 2C35 and the 2B24. Following this synthetic device training, students would transition to the UH-1 helicopter and be given sufficient aircraft training to meet Army student aviator performance requirements for entry into the Tactics portion of flight training.

The amount of training time the student would require prior to entering Tactics has been estimated at 10 hours in Device 2C35, 75 hours in Device 2B24, and 75 hours in the UH-1 aircraft. A test of the proposed program should seek to answer two major questions: (a) how much of the undergraduate flight training syllabus can be accomplished through appropriate use of Device 2B24, and (b) how much UH-1 aircraft time would be required following the device training?

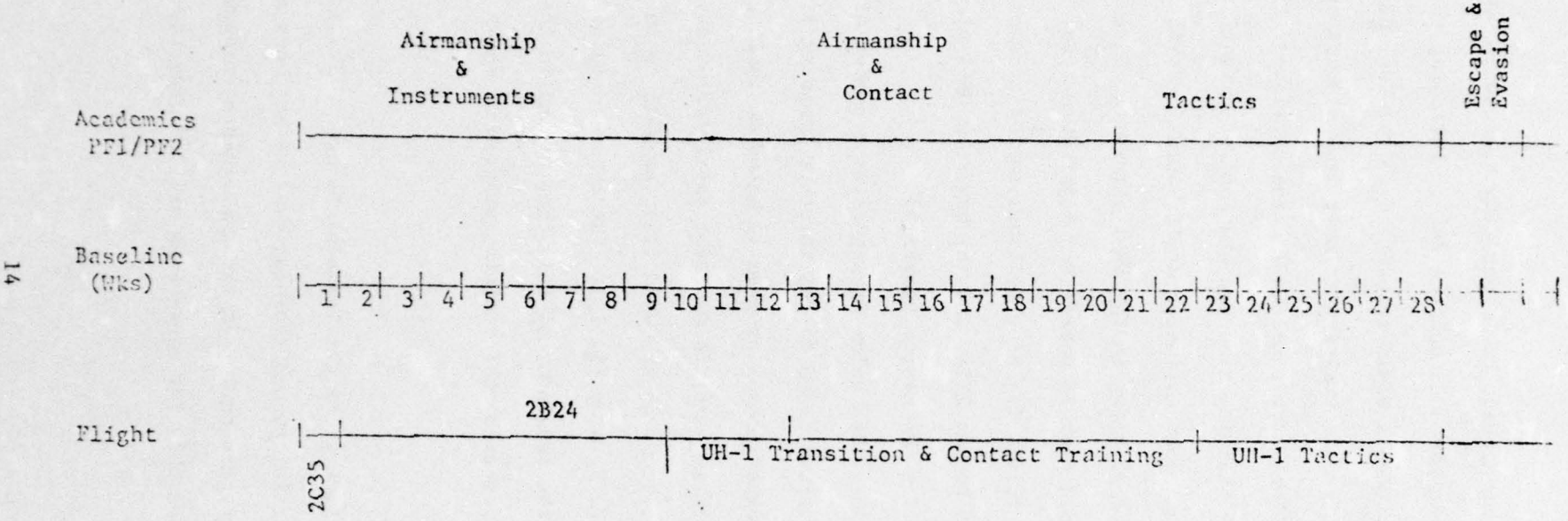
The program described below incorporates a number of training features and techniques found useful in other training programs. Their inclusion in the experimental program is based on their successful utilization, in whole or in part, in programs developed by the commercial airlines (13) and the U. S. Coast Guard (14), as well as in earlier HumRRO programs for the U. S. Army (5, 15). The major features and techniques are described in the remainder of this chapter and in the Appendices. A flow chart of the experimental training program is shown in Figure 2.

TRAINING CONCEPTS

Instructor Pilot as Flight Training Manager. Traditionally, instruction in flight simulators and training devices has been administered by non-rated enlisted personnel. In the experimental program, one instructor pilot is responsible for overseeing all training received by his

Figure 2

Experimental Undergraduate Flight Training Flow



students--in the briefing room, the cockpit procedures trainer, the simulator, and the aircraft. It is believed that this concept provides a highly efficient training method which maximizes training continuity and instructor/student familiarity, simplifies performance recording, enhances flight safety, and allows individualized instruction. Also, since the instructor is aware of his students' knowledges, skills, and capabilities prior to proceeding to the next phase of training, unnecessary duplication of effort and loss of valuable training time are held to a minimum.

Functional Context Training/Crew or Peer Training. As much subject matter as possible is presented in a functional, or mission oriented, context, rather than in isolation. Emphasis is placed on how to operate the aircraft and its subsystems to accomplish a given mission. The configurations of the 2C35 and 2B24 are well-suited to this approach, since they allow for pilot and copilot training to be conducted simultaneously, with each performing his respective duties as he will later in operational missions. This concept also allows the students to assist each other in the solution of training problems.

Verbalization of Maneuver. The student is required to recite to the instructor how he is going to perform a flight maneuver before he attempts to perform it in the simulator or the aircraft for the first time. The use of this procedure is based on the assumption that if the student cannot verbalize the procedural and aircraft control components of the task, the chances are he will be unable to perform it.

Proficiency Based Advancement. Each student progresses through the program at his own pace. His rate of progress is based on his individual

learning ability and motivation, rather than on the requirement to complete any set number of hours of instruction. The introduction of new material is keyed to the attainment of objectively determined student performance on certain maneuvers, techniques, and procedures.

EXPERIMENTAL TRAINING MATERIALS

Course Outline

The traditional format for documenting a flight training program involves specification of maneuvers to be performed during each hour of scheduled training. This format is unsatisfactory for documenting an individualized course in which the rate of progress through the required exercises is a function of the trainee's rate of mastery of the maneuvers involved. Therefore, the traditional course documentation format is not used for this program, since it would not facilitate individualized training. Instead, a Course Outline (see Appendix B) was developed which lists all of the activities and maneuvers for which training is to be provided in the 2C35, the 2B24, and the UH-1, in the sequence in which they are to be introduced and initially practiced by each trainee.

Academics

In the traditional program, academic material is presented in a variety of ways: lectures, programed texts, conferences, demonstrations, exercises, etc. Primarily, programed texts are proposed for use in the experimental program, and the entire course is self-paced. Because of the method used to present initial flight training, sequencing of academic material will differ, in most instances, from that given the

traditional student. The only content changes from the current undergraduate flight training program in academics are related to material concerning the TH-55 helicopter. Since students in the experimental program are not required to fly the TH-55, there is no requirement for them to learn systems information covering that aircraft.[1] In Appendix C, academic subjects have been arranged in a proposed sequence which parallels the instruction the student will receive in the 2C35, the 2B24, and the UH-1. Existing Aviation Center programed texts have been utilized wherever possible. Where programed texts are not available, proposed alternate media are indicated. The sequence shown is an approximation. Undoubtedly, changes would occur based on first-use experience. However, in order to assure that the student is adequately prepared academically for the instruction he will receive in the devices and the aircraft, he should have completed Items 1 through 6 (in Appendix C) prior to beginning training in the 2B24; Items 7 through 57 prior to beginning training in the UH-1 aircraft; and Items 58 through 90 prior to starting tactical training.

Data Forms

The data forms appearing in Appendices D, E, and F were developed for use during a planned evaluation of the proposed new program. As such, they are not necessarily considered as being suitable for operational use without testing and, probably modification. They are

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[1]It should be noted that a complete systems engineering of academic instruction in undergraduate flight training was beyond the scope of the present effort. It is believed, however, that substantial improvements to the proposed program could be achieved through such an undertaking.

presented here to provide examples of the type of information deemed necessary in a program of this sort.

Since most instructors will be unfamiliar with the use of these forms, considerable method of instruction (MOI) training, in addition to that typically given instructor pilots, will be required before instructors can be expected to employ the forms effectively.

Maneuver Performance Record Forms (MPRFs). The MPRF was designed to serve three principal functions, and reference to the specimen set in Appendix D will illustrate each. The first is to provide the instructor with an objective record form in which he can represent graphically the daily progress of each student. This purpose is achieved by requiring that he use the MPRF to score the student's *first* performance of a maneuver each training period. A (✓) or an (x) is used to indicate satisfactory or unsatisfactory performance, respectively, of each maneuver element.

The second function of the MPRF is to provide performance-specific feedback to the trainee concerning his performance on each maneuver he practiced each day, and to enable him to evaluate his progress with respect to that maneuver by comparing that day's performance with previous days' performance. The MPRF thus becomes a very effective communication tool between trainee and instructor.

The third function of the MPRF is to limit the amount of training the trainee receives in each maneuver. By requiring instructors to move on to other items as soon as the criterion of one errorless trial is achieved in a particular maneuver, the tendency of some instructors to overtrain can be reduced.

Amplified Checklist. The Amplified Checklist, a copy of which is at Appendix E, has been adapted from the descriptions of cockpit procedures given in the UH-1H Operator's Manual and is used as described in the Outline of 2C35 Training Periods shown in Appendix H. The checklist describes the tasks and sequences to be followed in the performance of various cockpit procedures. Included in the checklist is information concerning aircraft systems operation in both normal and abnormal modes. It should be noted that this underlying systmems information is presented in the context of actually performing the procedure. Space is provided on the checklist for recording student errors. Use of the checklist is continued until the criterion of one errorless trial is reached, and it thus functions similarly to the MPRF.

Checkride Forms. The checkride forms shown in Appendix F have been prepared to provide a standardized tool for determining student performance at various points in training. The checkride forms are to be completed by flight examiners who have themselves been trained in the proper administration of the checkride. These forms are more detailed than those typically used in Army checkride evaluations,[1] but they serve the same function. Forms are included for a pre-solo evaluation, an instrument checkride, and an advanced contact checkride. Additional checkrides for intermediate stages of training could, of course, be designed.

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[1]An exception is the Army's use of the Pilot Performance Description Record (PPDR) in the Primary Phase of undergraduate flight training. The PPDR is a product of previous HumRRO research.

In the traditional flight training program, learning to solo the helicopter is the first major hurdle facing the student. Students are expected to solo within their first 15 flight hours, and failure to do so within 20 hours may result in elimination from the flight training program. By contrast, students in the experimental program will not only have "soloed" the 2B24, but also will have developed flight skills far in advance of those of the typical pre-solo stage trainee. Consequently, there is no requirement in the new program to solo the UH-1 within a specified number of hours. In fact, solo is intended to be delayed so that greater proficiency can be built over a variety of skill areas. It is required, however, that the student demonstrate satisfactory performance of certain maneuvers and procedures prior to being allowed to solo. These maneuvers and procedures are indicated on the pre-solo data forms shown in Appendix F.

Most flight instructors would be generally familiar with the contents of the forms provided for the instrument checkride and the advanced contact checkride, since the performance standards for these do not differ from those employed in the usual undergraduate flight training program.

Mission Model

The outline for a basic IFR mission found at Appendix G has been developed as a general model of a typical IFR mission and represents the context within which all instrument training subsequent to that described in Appendix I is to be given. Daily flight training periods would consist of practice of all or portions of the listed items.

ADMINISTRATIVE PROCEDURES

General

In all phases of training--in the procedures trainer, the simulator, and the aircraft--each instructor will have two students. It is anticipated that each instructor will have the same two students throughout training.

Instructional periods will be two hours in Device 2C35 and three hours in Device 2B24. As nearly as possible, each period will be divided so that each student will have an equal opportunity to perform both pilot and copilot duties. Instructional periods in the UH-1 aircraft will remain as they are in the current program, i.e., of three hours duration, with each student spending approximately half that time acting as pilot and the other half observing the other student perform the pilot's duties (the instructor acts as copilot).

The typical flight instructor will be unfamiliar with teaching basic flight maneuvers to flight naive students in Device 2B24. He will, therefore, require some additional MOI training prior to teaching in the experimental program.

Device 2C35 Training

To use the 2B24 to provide the student with cockpit orientation, instrument familiarization, and initial systems training would be economically unwise. Therefore, a program to provide this initial training was designed around the 2C35 cockpit procedures trainer. The objectives of this training are to:

(a) Familiarize the student with the UH-1 cockpit environment;

(b) Teach him the location of all cockpit instruments, their purposes, and how to read them;

(c) Teach him how to use the pilot's checklist (TM 55-1520-210-10CL);

(d) Teach him the systems information necessary to insure that he can perform safe aircraft starts, run-ups, and shutdowns;

(e) Teach him to perform the pre-start check, engine start, engine run-up, engine shutdown, and how to use Forms 2408-12 and -13.

(f) Teach him the appropriate procedures for the following emergencies: hot start, hung start, low battery voltage, abnormal oil pressure, and high and low side governor failure.

In order to accomplish the above objectives, the student must learn:

(a) to identify the checklist item;

(b) the location of the item;

(c) to perform the task associated with the item (what to do with it and what happens);

(d) the required systems information which will allow him to use the system efficiently and to respond to cues indicating system or component parts malfunction and to take appropriate action to insure safety of flight.

Each student will be issued programed texts PT 55, Engine Start and Run-up, UH-1D/H, and PT 2018A, Description of UH-1H, which he will complete in that sequence prior to reporting to the 2C35 for the first period of instruction.

Each student will also be furnished copies of the pilot's checklist, TM 55-1520-210-10CL, and of the Amplified Checklist (from TM 55-1520-210-10, UH-1D/H Operator's Manual) shown in Appendix E.

It is intended that the instructors be trained during MOI to administer the training following the Course Outline (Appendix B) in the manner indicated in Appendix H (Outline of 2C35 Training Periods). The instructor initially assumes the teacher's role, explaining procedures and locating knobs, levers, and switches and defining their purposes and operation. As the student becomes more proficient, the instructor's role changes to that of moderator, evaluator, and interrogator. He initiates peer instruction, interacting only when the student can't solve the problem; scores errors; questions the students about instructional material covered; inserts malfunctions into the system to test knowledge of procedures, etc.

Speed in accomplishing item tasks on the checklist is desirable, but accuracy has priority. Operationally, cockpit procedures must be accomplished in periods of darkness, when cockpit visibility is degraded, as well as in daylight. Therefore, any technique which might insure that an item task is not improperly accomplished, or accidentally eliminated, should be used.

During the preliminary work with the experimental training program, the 2C35 training described here was thoroughly tested and found to be very effective in achieving the 2C35 training objectives indicated above. While it is anticipated that most students will master the objectives within approximately five 2C35 periods, they should be encouraged to practice using the checklist on their own time, either in a vacant 2C35

or at the learning center. Appendix H contains a detailed outline of the activities to take place during 2C35 training periods. Students who reach criterion performance are scheduled to begin Device 2B24 training the next period.

Device 2B24 Training

The purpose of this training is to teach the flight naive student the knowledges and skills required to enable him to operate the UH-1 under both normal and abnormal conditions and to complete successfully a standard instrument checkride. Students in the program, unlike traditionally trained students, will have had little or no flight training. While some students may have had ROTC fixed wing training, many may possess only those aviator knowledges and skills learned in the 2C35. The task for the instructor in this program is to take an individual who has never flown a helicopter before and train him to Army aviator instrument proficiency standards solely in Device 2B24.

The flight instructor will normally start the 2B24 training program in the copilot's seat. However, as quickly as possible, he will relinquish this position to his other student and initiate simultaneous crew training, at which point he will occupy the instructor/observer seat. From this position, using on-board controls and with assistance from the console operator, the instructor is able to control the training activities as well as the training environment. The 2B24 incorporates many unique capabilities designed to enhance the conduct of training. These capabilities are described in documents provided by the device manufacturer, and the instructor must be trained to use them effectively during MOI.

Training should be conducted in the manner indicated in Appendix I (Device 2B24 Training Periods) until the student has attained sufficient proficiency to pass a standard instrument checkride in the device. That checkride should be administered by an independent examiner (not by the student's instructor or another instructor from the same training flight) to assure objective evaluation of student capabilities (16).

UH-1 Aircraft Training

Following the successful completion of a standard instrument checkride in Device 2B24, students begin training in the UH-1 aircraft. The purpose of this training is threefold: (a) validation of instrument training received in the 2B24; (b) VFR qualification in the UH-1 aircraft; and (c) acquisition of the requisite skills and knowledges for entry into the Tactics Phase of UH-1 flight training.

To take full advantage of the positive training transfer from the 2B24 to the UH-1 aircraft and to familiarize the student with the aircraft and visual flight environment, the first flight should be flown along a route practiced in the 2B24, using both visual and instrument flight cues. The first part of the flight should be conducted under the hood, with the hood being removed occasionally to allow the student to compare visual and instrument cues. Visual flight training will be conducted using the integrated concept where practicable, and should follow the sequence outline in Appendix B (a more detailed outline for training periods is not provided since flight instructors are already familiar with instructing in the aircraft). As a supplemental aid to the maintenance of instrument flight proficiency during visual flight training, occasional 2B24 training periods will be scheduled.

Training continues in the fashion indicated until the student can pass an advanced contact checkride, at which time he advances to the Tactics Phase of flight training.

As noted earlier, the training program described in this report has not been tested. Portions of the program were tried out during the developmental process, but a planned full-scale evaluation of the program's feasibility for Army use was not accomplished. It is believed that the material in this report would be very useful if such an evaluation were undertaken.

LITERATURE CITED

AND

APPENDICES

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APPENDIX A

PUBLICATIONS AND RESEARCH BY-PRODUCTS
OF WORK UNIT SYNTRAIN

Publications

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Research By-Products

U-21 Cockpit Procedures Trainer

* U-21 CPT Program of Instruction

U-21 Paper Trainer

T-42 Paper Trainer

OV-1 Paper Trainer

GAT-2 Checklist

* Program of Instruction for Twin-Engine Qualification and Instrument Training

* Program of Instruction for Combat Readiness Proficiency Training

* Program of Instruction for Rotary Wing Instrument Training

* Program of Instruction for Initial Entry Rotary Wing Training

IFR Typical Mission Task List

* Method of Instruction (MOI) material included

APPENDIX B

COURSE OUTLINE

A. 2C35 Cockpit Procedures Training

1. Pre-start check

2. Start

3. Run-up

4. Emergencies
   a. Hot start
   b. Hung start
   c. Low battery voltage
   d. Abnormal engine oil pressure
   e. N_2 governor failure

B. 2B24 Flight Training

1. 2B24 briefing
   a. Description
   b. Capabilities

2. Cockpit orientation
   a. Door-motion interlock
   b. Motion system and control
   c. Freeze function and control
   d. Continue flight function and control
   e. Overhead light and control
   f. Cathode Ray Tube functions
   g. TV camera (if applicable)
   h. Instructor station

3. Development of flight control skills (IFR references)
   a. Roll control
      (1) Attitude indicator (roll component)
      (2) Lateral cyclic control
      (3) Radio magnetic indicator (RMI)
   b. Pitch control
      (1) Attitude indicator (pitch component)
      (2) Fore and aft cyclic control
      (3) Airspeed indicator
      (4) Altimeter
      (5) vertical velocity indicator

c. Power control
   (1) Collective pitch control
   (2) Torque pressure gauge
   (3) Effect on trim and use of pedals
   (4) Effect on airspeed
   (5) Effect on altitude
   (6) Use in turns
   (7) Effect of altitude on power
d. Cruise flight
   (1) Maintaining heading
      (a) RMI
      (b) Lateral control
      (c) Trim
   (2) Maintaining altitude
      (a) Altimeter
      (b) Pitch control
      (c) Airspeed indicator
      (d) Vertical velocity indicator
e. Changing airspeed
   (1) Power
   (2) Attitude changes
   (3) Heading control
   (4) Trim
f. Changing heading, standard and half-standard rate
   (1) Roll-in rate
   (2) Angle of bank
   (3) Turn needle
   (4) Altitude control
   (5) Airspeed control
   (6) Trim
   (7) Roll-out rate
g. Changing altitude
   (1) Power
      (a) Torque Meter
      (b) Vertical velocity indicator
   (2) Pitch control
      (a) Attitude indicator
      (b) Airspeed
   (3) Trim
   (4) Heading control
      (a) RMI
      (b) Attitude indicator
   (5) Altimeter
h. Level off
   (1) Altimeter
   (2) Power
   (3) Pitch
   (4) Trim
   (5) RMI

i. Changing heading and altitude
   (1) Entry

(a) Power
(b) Angle of bank
(c) Roll-in rate
(d) Pitch attitude
(e) Trim

(2) Maintaining
(a) Turn needle
(b) Vertical velocity indicator
(c) Airspeed
(d) Power

(3) Roll-out
(a) RMI
(b) Attitude indicator

(4) Level off
(a) Altimeter
(b) Power
(c) Pitch
(d) Trim
(e) RMI

j. Instrument takeoff (Demonstrate)
(1) Pre-takeoff check
(2) Power application
(3) Attitude control
(a) Pitch
(b) Roll
(4) Light on skids
(5) Engine instruments check
(6) Heading control
(7) Transition to climb, 500 FPM (Demonstrate)
(a) Power
(b) Vertical velocity indicator
(c) Airspeed
(d) Pitch
(e) Altimeter
(f) Trim
(8) Level off (Demonstrate)
(a) Power
(b) Pitch
(c) Trim
(d) Level off check

k. Ground controlled approach
(1) Radio communication procedure
(2) ASR
(3) PAR

l. Unusual attitudes
(1) Roll attitude
(2) Pitch attitude
(3) Power
(4) Trim

4. Radio procedures, IFR navigation, and emergency procedures (Demonstrate and Practice)
a. VOR

(1) Orientation
(2) Tracking
(3) Station passage
(4) Reporting
(5) Position fixing
(6) Holding procedures
(7) VOR approach
(8) VOR missed approach
(9) Cross-country flight planning

b. Under- and overspeeding N_2 governor failure (Demonstrate and Practice)

c. Engine failure emergency procedures--power recovery, IFR (Demonstrate and Practice)

d. ADF (Demonstrate and Practice)
(1) Orientation
(2) Tracking
(3) Station passage
(4) Position fixing
(5) Holding procedures
(6) ADF approach
(7) ADF missed approach

e. Radar procedures (Demonstrate and Practice)

f. Two-way radio failure

g. ILS (Demonstrate and Practice)
(1) Localizer interception
(a) Radar vector
(b) VOR radial
(c) ADF bearing
(2) Outer marker
(3) Localizer tracking
(4) Glide slope following
(5) Approach
(6) Missed approach

5. Cross-country exercises
Cross-country exercises should be planned to provide the student with an opportunity to practice all the skills, techniques, and procedures required for a standard instrument rating. These exercises should be practiced until that level of proficiency is reached. As soon as the student can demonstrate reasonable control of the device, as much training as possible should be conducted in the cross-country context.

C. UH-1 Contact Training and Instrument Flight Practice

1. Pre-flight and post-flight procedures

2. Cross-country flight

3. Hovering flight
   a. Stationary hover
   b. Landing from a hover
   c. Takeoff to a hover
   d. Hovering turns
   e. Clearing turns (90° turns)
   f. Anti-torque failure while hovering
   g. Moving hover
   h. Hovering autorotation

4. Deceleration

5. Use of forced trim

6. Traffic pattern
   a. Normal takeoff
   b. Upwind leg
   c. Crosswind leg
   d. Downwind leg
   e. Normal approach
   f. Exiting traffic pattern (leaving traffic)
   g. Entering traffic pattern (entering traffic)
   h. Go-around procedures

7. Servo-off flight

8. Autorotations
   a. Straight-in
   b. With turn

9. Forced landings

10. Power recovery

11. Pre-solo checkride

12. Instrument checkride

13. Stagefield proficiency
   a. Review and practice to required proficiency all previous maneuvers
   b. 180° hovering turns
   c. 360° hovering turns
   d. Quick stops
   e. Emergency procedures
   f. Internal loads
   g. Use of auxiliary equipment
   h. Hydraulic-off landing

i. Simulated anti-torque failure
j. *Maximum performance takeoff*
k. Steep approaches

14. Confined area, pinnacle, slope operations, and night flight
    a. Confined area and pinnacle operations
        (1) High reconnaissance
        (2) Low reconnaissance
        (3) Approach
        (4) Ground reconnaissance
    b. Slope operations
    c. Night flight
    d. Advanced contact checkride

15. Cross-country navigation
    a. Flight planning using aeronautical and tactical maps
        (1) Route plotting
        (2) Computing distance and direction
        (3) Course determination
        (4) Checkpoint selection
        (5) Off-course corrections

APPENDIX C

ACADEMICS

Title	Type Instruction*	
1. History and Development of the Helicopter and Aircraft Orientation	1.0 PI	
2. Rotary Wing Aerodynamics	0.6 PI	0.4 TV
3. Physical Laws	1.0 PI	
4. General Description UH-1H	2.0 PI	
5. Engine Start and Runup UH-1H/D	2.0 PI	
6. Flight Instruments	3.0 PI	
7. Flight Controls	3.0 C	
8. General and Visual Flight Rules	3.0 PI	
9. Pitot Static System and Magnetic Compass	2.0 PI	
10. DOD FLIP	2.0 PE	4.0 PI
11. Technical Publications, Aircraft Forms and Records, and Inspections	2.0 PI	
12. Communication Procedures and Radio Phraseology	1.0 PI	
13. Radar Procedures	1.7 PI	0.3 TV
14. PAR Approach	0.7 PI	0.3 TV
15. VOR Orientation and Tracking	1.6 PI	0.4 TV
16. VOR Enroute Navigation	2.0 PI	0.5 TV

*Legend

C = Conference
D = Demonstration
E = Examination
F = Film
FEX = Field Exercise
GS = Guest Speaker
PE = Practical Exercise
PI = Programed Instruction
TV = Television

Title	Type Instruction		
17. Instrument Flight Rules	2.0 PI		
18. VOR Approach Procedures	2.0 PI		
19. Transponder	1.0 PI		
20. Holding Procedures	2.0 PI		
21. Navigational Computer Slide Rule	3.0 PI		
22. Navigational Computer Wind Face	2.0 PI		
23. ADF Navigation	2.3 PI	0.7 TV	
24. ADF Approach	1.0 PI		
25. Enroute Charts and Supplement	2.5 PI		
26. ATC Agencies	3.0 PI		
27. IFR Communications	4.0 PI		
28. ATC Clearances	2.0 PI		
29. ILS	1.8 PI	0.7 TV	
30. The Atmosphere	1.5 PI	0.5 F	
31. Pressure and Winds	1.5 PI	0.5 F	
32. Air Masses and Clouds	0.6 PI	0.4 TV	
33. Frontal Weather	2.0 PI	1.0 E	
34. Thunderstorms	1.0 PI		
35. Sequence Reports, Forecasts and Winds Aloft	4.6 PI	0.4 TV	
36. Surface Weather Map	1.0 PI		
37. Weather Depiction and Radar Summary Charts	1.0 PI		
38. Weather Hazards	0.7 PI	1.5 F	0.8 PE
39. IFR Flight Plans	2.3 PI	3.0 PE	0.7 TV
40. Communications Failure and Emergency Procedures	4.0 PI		

Title	Type Instruction	
41. Weight and Balance	1.0 PI	1.0 PE
42. Gyrocompass Failure	1.0 PI	
43. Weather Fundamentals and Flight Planning	2.0 PI	
44. IFR Flight Planning	14.3 PE	0.7 TV
45. Aviation Fuels and Lubricants	1.0 PI	
46. Aircraft Hardware and Safetying Procedures	1.0 PI	
47. Fort Rucker Downed Aircraft Procedures	0.7 PI	1.3 TV
48. Administrative Responsibilities	1.0 PI	
49. Aircraft Accident Prevention and Investigation	1.0 PI	
50. Aeronautical Chart Symbols	2.0 PI	
51. Distance and Direction	0.7 PE	1.3 PI
52. Variation, Deviation and Wind Effect	2.0 PI	
53. Navigational Practical Exercise	1.0 PE	
54. Off Course Corrections	1.0 PI	
55. Performance Data Charts	1.0 PI	
56. Navigation Practical Exercise II and III	2.0 PE	
57. Aviation Medicine Orientation	2.0 C	
58. Wake Turbulence	0.7 PI	0.3 TV
59. Proximity Warning Device	1.0 PI	
60. Flight Plans (VFR)	1.0 PI	
61. Preflight and Postflight Inspections	2.0 PI	1.0 PE
62. Flight Line Orientation	2.0 C	
63. Forces Acting on the Rotor System	1.7 C	0.3 F
64. Rotor System in Translation	2.4 C	0.6 F
65. Rotor Blade Stalls	0.7 C	0.3 F

Title	Type Instruction
66. Use of Operator's Manual	1.0 PI 1.0 PE
67. Electrical System Components and Malfunctions	1.0 PI 1.0 PE
68. Power Train Components	1.0 PI 1.0 C
69. Main and Tail Rotor Systems	1.0 PI 1.0 C
70. Fuel System	1.0 PI 1.0 C
71. Engine Failure Emergency Procedure	3.0 D 1.0 P1 1.7 C 0.3 TV
72. Precautionary Measures and Emergency Procedures	0.3 TV 2.7 PI
73. Malfunction and Analysis	1.0 PI 1.0 C
74. Accident Prevention Literature	1.0 C
75. Unit Training and Standardization	1.0 C
76. Aircraft Operations and Emergency Procedures	1.0 C
77. Examination (Safety)	1.0 E
78. Altitude Physiology	3.0 C 2.0 PE1 (plus 10 hours altitude chamber)
79. G-Forces	1.0 C
80. Toxic Hazards in Aviation	1.0 C
81. Adverse Effects of Temperature Extremes	1.0 C
82. Noise in Aviation	1.0 C
83. Protective Equipment	1.0 C
84. Night Vision Orientation	0.5 C 0.5 D
85. Spatial Disorientation and Sensory Illusions of Flight	1.0 C
86. Stress and Fatigue	1.0 C
87. Review of Aviation Medicine and Life Support	1.0 C

Title	Type Instruction
88. Examination	1.0 E
89. Tactical Academic Orientation	1.0 C
90. Introduction to NATO Ground and Air Forces	2.0 GS or 0.5 C 1.5 F
91. Threat	2.5 C 0.5 F
92. Tactical Aircraft Communications	2.0 C
93. Unattended Ground Sensors	0.3 0.7 F
94. Aircraft Flares	1.3 C 0.5 D 0.2 F
95. Combat Intelligence	1.0 C
96. Helicopter Tactical Loads	2.0 PI
97. Communications Security	2.5 C 0.5 D
98. Communications Procedures	0.5 C 2.5 PE
99. Electronic Warfare	2.0 C
100. Air Cavalry Operations	2.0 C
101. Examination	2.0 E
102. Offense/Defense	3.0 C
103. Aerial Observation	2.0 C
104. Law of Land Warfare	1.0 C
105. Airmobile Operations	1.5 C 0.5 F 1.0 PE
106. Aircraft Vulnerability to Special Weapons	1.0 C
107. Tactical Flight NOE Briefing	2.0 C
108. Target Identification	2.0 C 2.0 PE3
109. Pathfinders and Tactical Landing Areas	1.0 C
110. Examination	2.0 E
111. Tactical Navigation	7.3 C 7.0 PE3 0.7 F

Title	Type Instruction		
112. Examination	3.0 E		
113. Fire Support Coordination	0.5 C	0.5 F	
114. Aerial Adjustment of Artillery	4.0 C	8.0 PE3	
115. Attack Helicopter Missions and Employment	2.0 C		
116. Examination	3.0 E		
117. Introduction to Survival	1.5 C		
118. Survival Medicine	2.0 C		
119. Overwater Survival	0.7 C	0.3 D	
120. Physiology of Food	1.0 TV		
121. Travel Techniques	1.5 C		
122. Camouflage	2.0 C	1.0 TV	1.0 PE1
123. Evasion	1.0 C		
124. Introduction to Resistance	2.0 C		
125. PW Organization	1.5 C		
126. Field Exercise	24.0 FEX		
127. Examination	2.0 E		
128. Prisoner Exploitation	3.0 C	2.0 F	1.0 TV

APPENDIX D

MANEUVER PERFORMANCE RECORD FORMS

MPRF - 1

STRAIGHT AND LEVEL (Two minutes) Cruise

STUDENT_____ Sheet No. ____

Date					
Altitude (±100')					
Direction (±10°)					
Ball centered (±½ ball)					
Errors					
Total prior time: 1st trial		Criteria reached			

LEVEL TURNS (Standard rate) 90° Cruise

Student _____ Sheet No. ____

Date					
Roll-in rate					
Rate of turn (½ needle)					
Altitude (±100')					
Degree turned (±10°)					
Roll-out rate					
Ball centered (½ ball)					
Errors					

Total prior time 1st trial : Criteria reached :

ACCELERATION AND DECELERATION

Student_____ Sheet No. ____

Date					
	ACCELERATION				
Power increase: 4 lbs (±1 lb)					
Pitch attitude: adjust to maintain alt. (±50')					
Ball centered (±½ ball)					
Heading control ±10°					
Airspeed: 100 kts (±5 kts)					
Power: reduce 2 lbs					
	DECELERATION				
Power decrease: 8 lbs (±1 lb)					
Pitch attitude: adjust to maintain alt. (±50')					
Ball centered (±½ ball)					
Heading control ±10°					
Airspeed: 70 kts (±5 kts)					
Power increase: 2 lbs					

ACCELERATION AND DECELERATION

ACCELERATION TO NORMAL CRUISE

Power increase: 6 lbs (±1 lb)					
Pitch attitude: adjust to maintain alt. (±50')					
Ball centered (±½ ball)					
Heading control ±10°					
Airspeed: 90 kts (±5 kts)					
Power decrease: 2 lbs					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

ALTITUDE CHANGES - ENROUTE
CLIMB (90 KTS)
(Record for 2000' from initial pitch change to start of level off)

Student_____ Sheet No ____

Date					
Power increase 5 lbs (±1 lb					
Attitude: level (±½ bar)					
Vertical speed 500 FPM (±100')					
Airspeed 90 kts (±10 kts)					
Ball centered (±½ ball)					
Direction VOR ±5°, ADF ±5°, Hdg ±10°					
	LEVEL OFF 90 KTS				
Led altitude (40')					
Airspeed 90 kts (±10 kts)					
Power reduced 5 lbs (±1 lb)					
Altitude (±100')					
Direction VOR ±5°, ADF ±5°, Hdg ±10°					
Ball centered (±½ ball)					
Errors					
Total prior time:	1st trial		criteria reached		

ALTITUDE CHANGES - ENROUTE
DESCENT (90 KTS)
(Record for 2000' from initial pitch change to start of level off)

Student_____ Sheet No. ____

Date					
Power decrease 5 lbs (±1 lb)					
Attitude level (±½ bar)					
Airspeed 90 kts (±10 kts)					
Ball centered (±½ ball)					
Direction VOR ±5°, ADF ±5°, Hdg ±10°					
	LEVEL OFF 90 KTS				
Led altitude (40')					
Airspeed 90 kts (±10 kts)					
Power increased 5 lbs (±1 lb)					
Attitude (±100')					
Direction VOR ±5°, ADF ±5°, Hdg ±10°					
Ball centered (±½ ball)					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

INSTRUMENT TAKE-OFF

Student_____ Sheet No. ____

Date					
Light on skids					
Power increase 5 lbs.(±1 lb.)					
Heading (10°)					
Attitude level (±½ bar)					
Established positive climb (Altimeter moving clockwise)					
Attitude: 1 bar low (-0, +1 bar)					
No assistance required					
Heading to 200' ($\pm 10^{\circ}$)					
INITIAL CLIMB (STRAIGHT) 2000' AFTER 80 KTS ESTABLISHED					
Attitude: 80 kts (±10 kts)					
Power 500 FPM (±100FPM)					
Heading ($\pm 10^{\circ}$)					
Trim proper (±½ ball)					
Errors					

Total prior time: 1st trial [ ] Criteria reached [ ]

CHANGING ALTITUDE AND HEADING
CLIMBING TURNS
(90 KTS - 500 FPM)
STANDARD RATE

Student_____ Sheet No ____

Date					
ENTRY					
Power increase 5 lbs (±1 lb)					
Pitch, bank and power control					
MAINTAINING					
Airspeed 90 kts (±10 kts)					
Rate of turn (standard rate ±½ needle)					
Vertical speed 500 FPM (±100')					
Ball centered (±½ ball)					
RECOVERY 90 KTS					
Led altitude (40')					
Pitch, bank and power control					
Degrees turned (±10°)					
Altitude 500' (±50')					
Power reduced 5 lbs (±1 lb)					
Ball centered (±½ ball)					
Airspeed 90 kts (±10 kts)					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

CHANGING ALTITUDE AND HEADING
DESCENDING TURNS
(90 KTS - 500 FPM)
STANDARD RATE

Student_____ Sheet No. ____

Date					
ENTRY					
Power decrease 5 lbs (±1 lb)					
Pitch, bank and power control					
MAINTAINING					
Airspeed 90 kts (±10 kts)					
Rate of turn (standard rate ±½ needle)					
Vertical speed 500 FPM (±100')					
Ball centered (±½ ball)					
RECOVERY					
Led altitude (40')					
Pitch, bank and power control					
Degrees turned (±10°)					
Altitude 500' (±50')					
Power increased 5 lbs (±1 lb)					
Ball centered (±½ ball)					
Airspeed 90 kts (±10 kts)					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

GCA

Student_____ Sheet No. ____

Date					
	INITIAL CALL				
Position report					
	TRANSITION				
Transponder procedures					
Heading control (±10°)					
Altitude (±100')					
Airspeed (±10 kts)					
	DOWNWIND				
Rolled out on heading (±10°)					
Heading control (±10°)					
Altitude (±100')					
Airspeed (±10 kts)					
Pre-landing check					
	BASE LEG				
Rolled out on heading (±10°)					
Heading control (±10°)					
Altitude (±100')					
Airspeed (±10 kts)					
Final cockpit check					

GCA

FINAL

Rolled out on heading (±10°)					
Heading control (±10°)					
Altitude (±100')					

APPROACH

Heading (±5°)					
Glideslope (follows instructions)					
Voice procedures					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

VOR ORIENTATION & RADIAL INTERCEPTION

Student_____ Sheet No. ____

Date					
Tuned station properly					
Identified station					
Identified radial					
Turned to proper intercept heading ($\pm 10^{o}$)					
Rolled out on course ($\pm 5^{o}$)					
Altitude (±100')					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

TRACK FOLLOWING
(Record for five minutes)

Student_____ Sheet No. ____

Date					
Maintained track (±5°)					
Altitude (±100')					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

UNUSUAL ATTITUDES
(Steep Descending Turn)

Student _____ Sheet No. ____

Date					
	RECOVERY				
Wings: level attitude					
Pitch: level attitude					
Power: adjust					
Trim					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

UNUSUAL ATTITUDES
(Steep Climbing Turn)

Student_____ Sheet No. ____

Date					
	RECOVERY				
Wings: level attitude					
Pitch: level attitude					
Power: adjust					
Trin					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

RADIO CROSS COUNTRY VOR / ADF

Student_____ Sheet No. ____

Date					
PREPARATION FOR TAKE OFF					
Radio calls					
Clearance					
Transponder					
TAKE OFF & CLIMB TO ALTITUDE					
Track (±5°) ADF ±5°					
Reports					
Procedures					
ENROUTE					
1st leg					
Altitude (±100')					
Track (±5°) ADF ±5°					
Ground speed computed					
Reports					
ETA					
Procedures					

RADIO CROSS COUNTRY VOR ADF

2nd leg

Altitude (±100')	☐	☐	☐	☐	☐
Track (±5°) ADF ±5°	☐	☐	☐	☐	☐
Ground speed computed	☐	☐	☐	☐	☐
Reports	☐	☐	☐	☐	☐
ETA	☐	☐	☐	☐	☐
Procedures	☐	☐	☐	☐	☐

3rd leg

Altitude (±100')	☐	☐	☐	☐	☐
Track (±5°) ADF ±5°	☐	☐	☐	☐	☐
Ground speed computed	☐	☐	☐	☐	☐
Reports	☐	☐	☐	☐	☐
ETA	☐	☐	☐	☐	☐
Procedures	☐	☐	☐	☐	☐

RADIO CROSS COUNTRY VOR / ADF

4th leg

Altitude (±100')					
Track(±5°) ADF ±5°					
Ground Speed Computed					
Reports					
ETA					
Procedures					
DESTINATION					
ETA					
Report					
Holding					
APPROACH					
Pre-landing check complete					
Time outbound					
Procedure turn altitude					
Track (±5°) ADF ±5°					
Low station altitude					
Min. altitude (-0, +100')					
Airspeed (90 kts ±10 kts)					
Reports					

RADIO CROSS COUNTRY VOR ADF

MISSED APPROACH

Time					
Power					
Report					
Procedure					
Errors					

Total prior time: 1st trial ; Criteria reached ;

ENGINE FAILURE
(During Flight)

Student_____ Sheet No. ____

Date					
Rotor RPM maintained (collective down)					
Ball centered (±½ ball)					
Glide established 80 kts (±10 kts)					
Called out RPM/N_1/AS					
Heading maintained (±10°)					
If time allows: Transponder set to EMER					
Transmit MAYDAY (3 times)					
Transmit A/C identification					
Transmit position					
Transmit nature of distress					
Main fuel: OFF (verbal only)					
Battery switch: OFF (verbal only)					
Shoulder harness: LOCK (verbal only)					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

HYDRAULIC POWER FAILURE

Student_____ Sheet No. ____

Date					
Adjust airspeed					
Hydraulic control circuit breaker: OUT					
Hyd. control circuit breaker: IN (if power not restored)					
Hydraulic control switch: OFF					
Master caution warning light: RESET					
Landing: Accomplish					
Errors:					

Total prior time: 1st trial [:] Criteria reached [:]

OVERSPEEDING N_2 GOVERNOR
(High RPM)

Student_____ Sheet No. ____

Date					
Establish Operating RPM: Increase collective					
Retard throttle					
Maintain operating RPM (with collective and throttle)					
Land at first available safe landing area					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

UNDERSPEEDING N_2 GOVERNOR
(Low RPM)

Student_____ Sheet No ____

Date					
Collective: Down to maintain rotor RPM					
Throttle: RETARD					
Governor switch: EMER					
Governor RPM INC-DECR switch: DECREASE					
Throttle: Advance slowly and firmly to obtain operating RPM					
Errors					

Total prior time: 1st trial [:] Criteria reached [:]

ILS

Student_____ Sheet No. ____

Date					
TRANSITION					
Tune radios and identify sta.					
Track (VOR ±5°) (ADF ±5°) Radar vector (±10°)					
Altitude (±100')					
OUTER MARKER OR INITIAL APPROACH FIX					
Turn					
Report					
Altitude (±100')					
HOLDING					
Entry					
Report					
Heading outbound (±10°)					
Track inbound (±2 1/2°)					
Timing					
Altitude (±100')					
PROCEDURE TURN					
Pre-landing check completed					
Timing					
Procedure turn altitude					

ILS

TRACKING INBOUND

Rolled out on course					
Track (±2 1/2°)					
Altitude (±100')					

OUTER MARKER INBOUND

Intercept altitude (±100')					
Report					
Airspeed 90 kts (±10 kts)					

APPROACH

Localizer (±2 1/2°)					
Glideslope (in the doughnut)					
Min. altitude (-0, +100')					

MISSED APPROACH

Time/DH					
Power as required					
Report					
Prescribed procedures					

Errors					

Total prior time: 1st trial [:] Criteria reached [:]

TAKEOFF TO HOVER

Student_____ Sheet No. _____

Date					
Collective pitch application (smooth and positive)					
Heading ($\pm 5^{o}$)					
Drifts (±1')					
Altitude (3' ±1')					
Errors:					

Total prior time: 1st trial [:] Criteria reached [:]

NORMAL APPROACH

Drift (±1')					
Assistance Required					
Approach Termination (to touchdown)					
Heading (±5°)					
Touchdown					
Attitude					
Assistance Required					
Errors:					

Total prior time: 1st trial [ ] Criteria reached [ ]

MAXIMUM PERFORMANCE TAKEOFF (40 kts or 100')

Student_____ Sheet No. ____

Date					
Prior to takeoff Determine hover power					
Note OAT					
Determine power available (Go No-Go)					
Takeoff Light on skids properly					
Power application Smooth					
Amount (2% (H-1H)					
Heading ($\pm 5^{O}$)					
Attitude (40 kts ±10 kts)					
Ground track proper					
Assistance required					
Errors:					

Total prior time: 1st trial : Criteria rea hed :

STANDARD AUTOROTATION (Stagefield or Sod Touchdown)

Student_____ Sheet No. _____

Date					
Entry					
Collective pitch Full down					
Trim (±1/2 ball)					
Rotor RPM (in the green)					
Descent					
Heading (as required)					
Landing area (adequate)					
Airspeed					
Rotor RPM (in the green)					
Landing Approach					
Deceleration					
Collective pitch (as required)					
Heading (±5°)					
Ground track					
Touchdown					
Attitude					
Collective pitch (as required)					
Assistance required					
Errors:					

Total prior time: 1st trial [:] Criteria reached [:]

STEEP APPROACH

Student _____ Sheet No. ____

Date					
Prior to entry Altitude (±50')					
Airspeed					
Ground track					
Approach entry Entry point (12-15°)					
Collective pitch reduction					
Approach Descent (12-15°)					
Rate of closure					
Approach termination Heading (±5°)					
Touchdown					
Attitude					
Assistance required					
Errors:					

Total prior time: 1st trial [:] Criteria reached [:]

SIMULATED ANTI-TORQUE FAILURE

Student_____ Sheet No. _____

Date					
Initially					
Throttle (manual control)					
Engine RPM (6400)					
Ground track					
Altitude (±100')					
Approach entry					
Entry point (5-8°)					
Power use					
Airspeed 60 kts ±5 kts)					
Engine RPM (6400 L.P. 6200)					
Approach					
Descent 5-8°)					
Deceleration					
Engine RPM (6400 L.P. 6200)					
Ground track					
Touchdown					
Airspeed (at or above translational lift)					
Throttle use					
Collective pitch use					

SIMULATED ANTI-TORQUE FAILURE

Assistance required					
Errors:					

Total prior time: 1st trial [:] Criteria reached [:]

APPENDIX E

AMPLIFIED CHECKLIST: UH-1D/H

Dates				

BEFORE STARTING ENGINE

1. Entrance Doors - Secured.					

Cargo doors may be secured in full open position only if appropriate modifications have been made to the doors and airframe. If a cargo door comes open while in flight, reduce forward spped below 60 knots and secure door.

2. Seat and Pedals - Adjust.					
3. Seat Belt and Shoulder Harness - Fasten and adjust.					
4. Shoulder Harness Lock - Check.					
5. Cyclic, Collective, and Throttle Friction - OFF.					
6. Cyclic, Collective Pitch, and Pedals - Check travel, center cyclic, and pedals. Place collective pitch full down.					
7. Landing Light and Searchlight - OFF					
8. AC Circuit Breakers - IN.					
9. All Radio Equipment - OFF; Set on desired frequencies.					
10. GOVernor - GOV AUTO.					
11. DE-ICE - OFF.					
12. INT AUX FUEL Boost Pump - OFF					
13. LOW RPM AUDIO - OFF or check, spring loaded.					

14. MAIN FUEL - OFF

(O)* 15. START FUEL - OFF

16. HYDraulic CONTROL Switch - ON.

17. FORCE TRIM - ON.

18. CHIP DETector Switch - Spring loaded to BOTH.

19. Compass Slaving - IN (MAG HDG if applicable).

20. Instruments - Check static indications, slippage marks, and operating range limit markings.

21. Turn and Slip Indicator - Check race full of fluid.

22. Marker Beacon - OFF.

23. Clock - Wound and running.

24. Magnetic Compass - Check full of fluid and deviation card.

25. VSIs - Note indication.

26. Heading Indicators - Check RMI selector switch in ADF position, calibration card posted.

27. Altimeters - Set to field elevation.

28. Airspeed Indicators - Note indication.

29. Free-Air Temp Gage - Check reading and condition.

30. STARTER GENerator Switch - START.

31. NON-ESSential BUS - NORMAL ON.

32. VM Selector Switch - BAT (check 24 volts on DC voltmeter), then to MAIN GEN if APU start.

33. MAIN GENerator Switch - ON and cover down.

34. AC PHASE Selector - AC phase.

35. INVTR Switch - OFF.

36. Instrument Lights - OFF (Set as desired for night flights).

37. DC Circuit Breakers - IN, except for armament and special equipment.

38. PITOT HTR - OFF.

39. DOME LT - OFF (except for night flight).

40. EXternal LTS - OFF (FLASH for night flights as desired).

41. ANTI COLLision Light - OFF.

42. WIPERS - OFF.

Note

Wipers must not be operated on dry windshield.

43. CARGO RELease Switch - OFF.

44. Cabin Heating Switches - OFF.

STARTING ENGINE

1. BATtery Switch - OFF. (ON for battery start).

2. Copilot's Attitude Indicator - Cage (for APU start only).

3. INVTR Switch - SPARE (OFF for battery start).

4. FIRE DETECTOR Light - TEST (15 seconds maximum).

5. RPM Warning Light - ON.

6. Fuel Filter and Cargo Release Lights - Press to test.

7. Fuel Gage Test Switch - If APU start, depress until fuel quantity drops approximately 200 pounds, then release and check that gage returns to original indication.

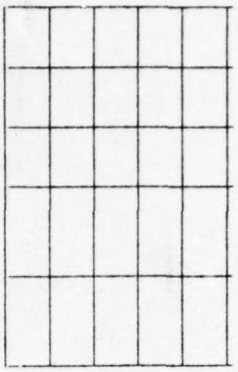
8. Caution Panel Warning Lights - TEST and RESET master caution light.

9. MAIN FUEL Switch - ON (Check fuel pressure [APU START]).

(O) 10. START FUEL - ON.

11. GOVernor RPM INC-DEC Switch - DEC for 10 seconds.

12. Throttle - Check Full Travel and return to flight idle; check operation of engine idle stop, then move throttle to full closed; position throttle as near as possible (on decrease side) of the flight idle stop.



(N)* 13. DOME LT - OFF.

14. Fireguard - Posted.

15. Rotor Blades - Clear and untied - verbally announce "CLEAR."

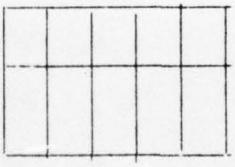
16. Start Switch (Trigger) - and Hold; start time; use installed timing device.

Note

During a battery start a minimum of 24 volts should be indicated on the DC voltmeter before attempting start. However, a battery start can be made when voltages less than 24 volts are indicated, provided the indicated battery voltage does not drop below 14 volts with the starter energized.

Caution

Limit starter energize time to 40 seconds. If engine does not start, a 3-minute cooling period is required before beginning another starting cycle. Only three 40-second starting attempts are permissible in any one-hour period.

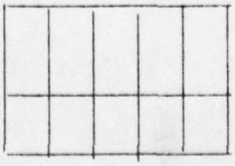


(O) 17. Start Fuel - OFF at 400°C.

18. Release starter switch at 40% gas producer rpm or after 40 seconds, whichever occurs first.

Caution

During starting or acceleration, the maximum allowable EGT is 760°C. If EGT exceeds 760°C for any period of time, or 650°C (L-13-675°C) for more than 5 seconds, an entry in the 2408-13 is required. If during starting or acceleration it becomes apparent that EGT will exceed 650°C (L-13-675°C) ABORT THE START as follows: throttle full off, fuel system off and continue to motor the starter until EGT decreases.



19. Copilot's Attitude Indicator (Battery Start) - Cage.

20. INVTR Switch (Battery Start) - To SPARE.

21. Throttle - Slowly advance past engine idle stop to flight idle position. Manually check flight idle stop by attempting to roll throttle off.

22. Gas Producer - 55% to 59% (68% to 72%-L-13).

Note

A slight rise in N_1 may be anticipated after releasing pressure on twist grip.

23. Engine Oil Pressure - 25 psi minimum.

24. Transmission Oil Pressure - Check normal.

Caution

If no oil pressure is evident at this time, shut engine down immediately and investigate the cause.

(N) 25. All Interior Lights - as desired.

26. Auxiliary Power Unit (APU Start) - Disconnect.

Caution

Check external power disconnected prior to turning battery switch on.

27. Battery Switch (APU Start) - ON.

28. Fuel Gage Test Switch (Battery Start) - Depress until fuel quantity gage drops approximately 200 pounds, then release and check that gage returns to original indication.

ENGINE RUN-UP

Caution

Full forward movement of cyclic may result in damage to short shaft.

1. ICS and Radios - ON as desired.

2. FORCE TRIM Switch - Check in ON position; press release button on cyclic stick to insure proper function; place switch in OFF position and check cyclic and anti-torque controls for freedom of movement and tippath plane for correlation with cyclic movement.

3. HYDraulic CONTrol Switch - Place in OFF position. Check controls for freedom of movement, insure that the collective pitch control is FULL DOWN; then place the switch in the ON position and position the FORCE TRIM Switch ON.

4. Helmet - ON.

5. FUEL SYSTEM AND DE-ICE - FUEL TANK SUMP PUMP circuit breaker out; set CABIN HEAT bleed air selector to position no. 2 (ON if applicable). DE-ICE - ON, Note EGT increase, FUEL TANK SUMP PUMP circuit breaker in, air selector off, DE-ICE OFF. Note fuel pressure returns to normal and EGT decreases. The following is applicable to helicopters serial nos.69-15292 and subsequent: Fuel Boost Pumps - Pull LEFT FUEL BOOST circuit breaker, note caution light on and normal fuel pressure. Pull RIGHT FUEL BOOST circuit breaker, note caution lights on and 0 fuel pressure. After 10 seconds press LEFT FUEL BOOST circuit breaker in, note caution light out, normal fuel pressure. Press RIGHT FUEL BOOST circuit breaker in, all caution lights out. De-Ice/Hot Air-ON, note EGT increase, OFF, note EGT decrease.

6. Throttle - Slowly increase to full open. Engine rpm (N_2) should stabilize at 6000 plus or minus 50 rpm. Throttle friction as desired.

7. PITOT HTR Switch - ON. Note loadmeter increase - then OFF.

8. AC PHASE Selector - Check all phases for reading of 115 plus or minus 4 volts; leave in BC.

9. INVTR Switch - To OFF position check for caution light indication. Switch to MAIN ON check caution light OFF.

10. AC PHASE Selector - Check all phases for reading of 115 plus or minus 4 volts; leave in the AC position.

11. VM Selector Switch - Check all positions for indication of 28 to 28.5 volts (27 to 27.5 on standby position); leave in NON-ESSential BUS position.

12. Main Generator - To OFF position; check caution light indication.

13. STARTER GENerator - To STBY-GEN position. Main generator loadmeter should indicate "zero" and standby generator loadmeter should indicate a load.

14. NON-ESS BUS Switch - Check voltmeter indication of "zero" with nonessential bus switch in NORMAL ON position; NON-ESS BUS switch to MANUAL ON, recheck 27 to 27.5 voltmeter reading; switch to NORMAL ON position.

15. VM Selector Switch - Check remaining positions for indication of 27 to 27.5 volts (28 to 28.5 on Main Gen); leave in MAIN GEN position.

16. MAIN GENerator - ON and guard closed.

17. All Engine and Transmission Instruments - Check for proper indication.

18. LOW RPM Switch - AUDIO.

19. Governor RPM INC-DEC Switch - Actuate through full range 6000 to 6700 plus or minus 50 rpm. Set rpm at 6600. During governor INC-DEC check, observe low rpm audio and warning light OFF at 6100 +100 engine rpm and/or 300 +5 rotor rpm.

(I) 20. Communication and Navigation Radios - Perform operational check of all radios and position to ON, as desired; set course selectors as desired.

21. Clock - Set.

(I) 22. Heading Indicator - Indicates plus and 0.

Note

Refer to Chapter 5 of TM 55-1520-210-10 for pre-flight checks and free gyro mode operation.

(I) 23. MAG Compass - Corresponds with heading indicator.

(I) 24. Altimeter - Determine K-factor.

(I) 25. Attitude Indicator - Set as desired.

26. ANTICOLLision Light - As desired.

27. FORCED TRIM Switch - As desired for flight.

28. Collective Pitch Friction - Check; set as desired.

PRIOR TO INSTRUMENT TAKEOFF

(I) 1. VSI, Altimeter - Indicates climb, descent.

(I) 2. Turn Needles, Heading Indicator, and Magnetic Compass indicate a Turn to Right - Left.

(I) 3. Slip Indicator - Ball free in race.

(I) 4. Attitude Indicator - Indicates nose high, nose low, bank left, right.

(I) 5. Airspeed Indicator - Note indication.

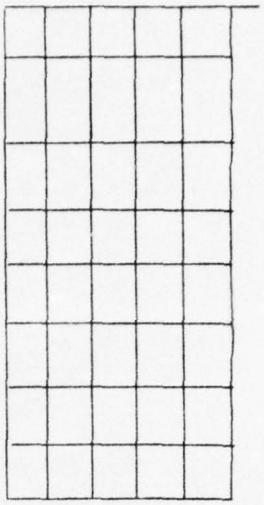
(I) 6. ENGine and TRANSmission Instruments - in green.

(I) 7. ENGine RPM - As desired.

(I) 8. Torque - Note psi for hover.

(I) 9. Index over takeoff heading - Set heading.

(I) 10. PITOT HEAT - ON if necessary



BEFORE TAKEOFF

Immediately prior to takeoff, the following checks will be accomplished and announced orally:

1. RPM.

2. Fuel Quantity.

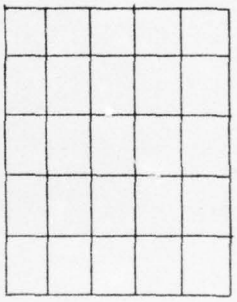
3. Instruments.

4. Caution Lights.

5. Low RPM Audio Warning Switch - AUDIO.

Warning

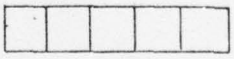
Suspend operations immediately if engine or transmission oil pressure and temperature are not within operating limits.



6. Bleed Air Switch - OFF

Caution

The bleed air heater should be in the OFF position during takeoff and landing and other flight conditions requiring maximum engine power available.

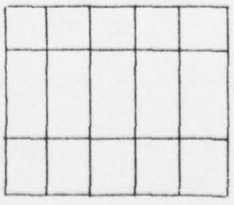


ENGINE SHUTDOWN

1. Collective Pitch - FULL DOWN

2. Throttle - Reduce to flight idle. Check N_1 speed 56% to 58% (70% to 72%, L-13).

3. LOW RPM Audio - OFF after checking operation.



4. FORCE TRIM - ON.

5. STARTER-GENerator Switch - START position.

(N) 6. EXTernal Lights - FLASHING.

7. Exhaust Gas Temp - Allow to stabilize (minimum of 2 minutes).

Caution

If a rapid rise in EGT is noted, motor the engine (throttle closed) to allow temperature to stablilze within limits.

8. Throttle - FULL OFF.

9. Main Fuel Switch - OFF.

10. Radios and ICS - OFF.

11. All Electrical Switches - OFF except main generator and battery.

12. Navigation Lights - OFF, after rotor is tied down.

13. ANTICOLLision Light - OFF.

14. Battery - OFF, after engine tachometer reads "zero." (Night, after NAV lights are turned OFF.)

15. Main Rotor Blades - Tie down.

16. Conduct a thorough walk-around inspection of the aircraft. (Check oil levels and check for visible leaks.)

17. Complete DA Form 2408-12 and -13.

---

*NOTE:

(I) - Instrument Flight Only

(N) - Night Flight Only

(O) - If Equipment Installed

APPENDIX F

Pre-Solo Checkride Recording Form

Instrument Checkride Recording Form

Advanced Contact Checkride Recording Form

PRE-SOLO CHECKRIDE RECORDING FORM

STUDENT:	RANK:	SSAN:
DATE:	AIRCRAFT:	FLIGHT TIME THIS PERIOD:
INSTRUCTOR:	EXAMINER:	EVALUATION:

WEATHER CONDITIONS:

Ceiling _____ Visibility _____

TURBULENCE:

☐ Calm ☐ Light ☐ Moderate ☐ Severe

1. TENSION: Interefered with performance ☐ No ☐ Yes

2. PREFLIGHT:

☐ Preflight Inspection ☐ Before Engine Start

☐ Engine Start ☐ Engine Runup

☐ Use of Checklist

3. ORAL:

☐ Aerodynamics ☐ Emergency Procedures

4. BEFORE TAKEOFF CHECK:

☐

COMMENTS: _____

_____

_____ has/has not demonstrated satisfactory working knowledge of the required maneuvers/procedures and is/is not cleared for solo flight in the UH-1 helicopter.

_____ _____

Student Pilot Check Pilot

The student will demonstrate a working knowledge of the following maneuvers and/or procedures on a pre-solo checkride prior to being cleared for the first supervised solo:

1. Preflight Inspection ☐
2. Cockpit Procedures ☐
3. Traffic Patterns ☐
4. Hovering Flight ☐
5. Normal Takeoff/Approach ☐
6. Straight and Level Flight ☐
7. Normal Climb and Descent ☐
8. Level Turns ☐
9. Climbing and Descending Turns ☐
10. Simulated Engine Failure Procedures ☐
11. Deceleration ☐
12. Use of Force Trim ☐
13. Hovering Autorotation ☐
14. Standard Autorotation ☐
15. Simulated Anti-Torque Failure ☐
16. Simulated Hydraulic Failure ☐
17. N_2 Governor Failure Operations ☐

AD-A033 587 HUMAN RESOURCES RESEARCH ORGANIZATION ALEXANDRIA VA F/G 5/9
TRAINING PROGRAMS FOR THE SYNTHETIC FLIGHT TRAINING SYSTEM.(U)
JUN 75 O B JOLLEY, R N ISLEY, E J MILLER DAHC19-73-C-0004
UNCLASSIFIED HUMRRO-FR-CD(D)-75-3 NL

2 OF 2
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DATE
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2-77

INSTRUMENT CHECKRIDE RECORDING FORM

STUDENT:	RANK:	SSAN:
DATE:	AIRCRAFT:	FLIGHT TIME THIS PERIOD:
INSTRUCTOR:	EXAMINER:	EVALUATION:

WEATHER CONDITIONS:

Origin_____ Destination_____

Ceiling_____ Vis_____ Ceiling_____ Vis_____

Wind: Velocity_____ Dir_____ Velocity_____ Dir_____

TURBULENCE:

[ ] Calm [ ] Light [ ] Calm [ ] Light

[ ] Moderate [ ] Severe [ ] Moderate [ ] Severe

1. TENSION: Interfered with performance [ ] No [ ] Yes

2. ORAL:

[ ] Emergency Procedures [ ] ATC Procedures [ ] Regulations

3. FLIGHT PLANNING:

[ ] Publications [ ] Weather [ ] Form 175 [ ] Flight Log

[ ] Alternate

COMMENTS:_____

_____

_____

_____

_____has/has not satisfactorily demonstrated necessary skills and knowledges for issuance/renewal of a standard instrument rating in the UH-1 helicopter.

_____ _____

Pilot Examiner

4. EQUIPMENT CHECK:

[ ] Instruments & Publications [ ] Communication Equipment [ ] Navigation Equipment

[ ] Engine

5. CLEARANCE: _____

_____

_____

_____

_____

_____

6. DEPARTURE PROCEDURES: (To primary airway)

[ ] Instrument Set-up [ ] Transponder Procedures [ ] Before Takeoff Check

[ ] Communications [ ] SID Procedures

Aircraft Control:

[ ] Climb (500 fpm ±100)

[ ] Track (VOR ±2°, ADF ±5°, Heading ±10°)

[ ] Altitude (±100')

[ ] Airspeed ±10 kts

[ ] Trim (± ball)

[ ] Level Off Check

7. ENROUTE:

- [ ] Altitude ±100'
- [ ] Track (VOR ±5°, ADF ±5°, Heading ±10°)
- [ ] Reports
- [ ] ETAs (±3 mins)
- [ ] Airspeed (90 kts ±10 kts)
- [ ] Trim: Ball centered ±½

Holding: [ ] Entry [ ] Timing [ ] Pattern

Procedures:

- [ ] Position Fixing
- [ ] Lost Communication
- [ ] Communication
- [ ] Use of Co-pilot

8. APPROACH: VOR ±2° mark left side: ADF ±5° mark right side

- [ ] Pre-landing Check
- [ ] Vector to Final Course (Yes - No)
- [ ] Trim (±½ ball)

Procedure Turn:

- [ ] Distance
- [ ] Published ±100' Altitude
- [ ] Pattern

Inbound:

	Track
	Rate of Descent
	Airspeed (90 kts ±10 kts)
	Low Station Altitude (±100')

Final:

	Report (Low station inbound)
	Track
	Rate of Descent
	Airspeed (90 kts ±10 kts)
	Min. Altitude (-0, +100')

Missed Approach:

	Time
	Power Proper
	Report
	Procedure
	Trim (±½ ball)

9. ILS APPROACH:

Transition:

[ ] Tune Radios and Identify Station

[ ] Track (VOR ±5°, ADF ±5°, Vector ±10°)

[ ] Altitude (±100')

Outer Marker:

[ ] Turn

[ ] Report

[ ] Altitude (±100')

Holding: [ ] Entry [ ] Timing [ ] Pattern

[ ] Pre-landing Check Completed

Procedure Turn:

[ ] Distance [ ] Published ±100' Altitude [ ] Pattern

Inbound:

[ ] Track (±2½°)

[ ] Altitude (±100')

[ ] Airspeed (90 kts ±10 kts)

Outer Marker Inbound:

- [ ] Intercept Altitude (±100')
- [ ] Report

Approach:

- [ ] Localizer (±2½°)
- [ ] Glideslope (In the doughnut)
- [ ] Trim (±½ ball)
- [ ] Minimum Altitude (-0, +100')
- [ ] Airspeed (90 kts ±10 kts)

Missed Approach:

- [ ] Time/DH
- [ ] Power Proper
- [ ] Procedure
- [ ] Trim (±½ ball)

10. GROUND CONTROLLED APPROACH

Initial Call:

[ ] Communication Procedures

[ ] Position Report

Transition:

[ ] Transponder Procedures

[ ] Heading Control (±10°)

[ ] Altitude (±100')

[ ] Airspeed (90 kts ±10 kts)

[ ] Trim (±½ ball)

Pattern:

[ ] Rolled out on Heading (±10°)

[ ] Heading Control (±10°)

[ ] Altitude (±100')

[ ] Airspeed (90 kts ±10 kts)

[ ] Trim (±½ ball)

[ ] Pre-landing Check

Final:

☐ Turn (Rolled out on Heading ±10°)

☐ Heading Control (±5°)

☐ Glideslope Satisfactory

☐ Airspeed (90 kts ±10 kts)

☐ Trim (±½ ball)

☐ Voice Procedures

11. ENGINE FAILURE (During Flight):

- [ ] Rotor RPM Maintained (Collective Down)
- [ ] Ball Centered (±½ ball)
- [ ] Glide Established 80 kts (±10 kts)
- [ ] Called out RPM/N_1/AS
- [ ] Heading Maintained (±10°)

If time allows:

- [ ] Transponder set to EMER
- [ ] Transmit MAYDAY (3 times)
- [ ] Transmit A/C Identification
- [ ] Transmit Position
- [ ] Transmit Nature of Distress
- [ ] Main Fuel: OFF (Verbal Only)
- [ ] Battery Switch: OFF (Verbal Only)
- [ ] Shoulder Harness: LOCK (Verbal Only)

12. HYDRAULIC POWER FAILURE:

- [ ] Adjust Airspeed
- [ ] Hydraulic Control Circuit Breaker: OUT
- [ ] Hydraulic Control Circuit Breaker: IN (If Power Not Restored)
- [ ] Hydraulic Control Switch: OFF
- [ ] Master Caution Warning Light: RESET
- [ ] Landing: Accomplish

13. UNUSUAL ATTITUDES (Steep Climbing Turn)

- [ ] Wings: Level Attitude
- [ ] Pitch: Level Attitude
- [ ] Power: Adjust
- [ ] Trim (±½ ball)

14. UNUSUAL ATTITUDES (Steep Descending Turn)

- [ ] Wings: Level Attitude
- [ ] Pitch: Level Attitude
- [ ] Power: Adjust
- [ ] Trim (±½ ball)

ADVANCED CONTACT CHECKRIDE RECORDING FORM

STUDENT:	RANK:	SSAN:
DATE:	AIRCRAFT:	FLIGHT TIME THIS PERIOD:
INSTRUCTOR:	EXAMINER:	EVALUATION:

WEATHER CONDITIONS:

Ceiling_____ Visibility_____

Wind: Direction_____ Velocity_____

TURBULENCE:

☐ Calm ☐ Light ☐ Moderate ☐ Severe

1. TENSION: Interfered with performance ☐ No ☐ Yes

2. PREFLIGHT:

☐ Preflight Inspection ☐ Before Engine Start

☐ Engine Start ☐ Engine Runup

☐ Use of Checklist

3. ORAL:

☐ Aerodynamics ☐ Emergency Procedures ☐ Operators Manual

4. BEFORE TAKEOFF CHECK:

☐

COMMENTS: _____

_____

_____

_____has/has not demonstrated necessary skills and knowledges required for qualification in the UH-1 helicopter.

_____ Pilot

_____ Checkpilot

5. TAKEOFF TO HOVER:

- ☐ Collective Pitch Application (Smooth and Positive)
- ☐ Heading (± 5°)
- ☐ Drift
- ☐ Hovering Altitude

6. HOVERING FLIGHT:

- ☐ Altitude
- ☐ Heading (±5°)
- ☐ Hovering Speed
- ☐ Turns

7. LANDING FROM A HOVER:

- ☐ Use of Collective Pitch
- ☐ Heading (±5°)
- ☐ Descent
- ☐ Drift
- ☐ Touchdown

8. NORMAL TAKEOFF:

a. Through Effective Translational Lift

- ☐ Pre-Takeoff Check
- ☐ Clearing Turn
- ☐ Light on Skids
- ☐ Power Application
- ☐ Acceleration
- ☐ Heading (±5°)
- ☐ Trim (±½ ball)

b. After Effective Translational Lift

- ☐ Airspeed (60 kts ±10 kts)
- ☐ Rate of Climb (500' ±100')
- ☐ Ground Track
- ☐ Trim (±½ ball)

9. TRAFFIC PATTERN:

- [ ] Airspeed (90 kts ±10 kts)
- [ ] Altitude(±100')
- [ ] Ground Track
- [ ] Spacing
- [ ] Trim (±½ ball)

10. NORMAL APPROACH:

a. Base Leg

- [ ] Turn
- [ ] Deceleration (60 kts ±5 kts)
- [ ] Descent
- [ ] Ground Track

b. Final

- [ ] Turn
- [ ] Altitude (±50')
- [ ] Airspeed (60 kts ±5 kts)
- [ ] Ground Track

c. Approach Entry

- [ ] Entry Angle
- [ ] Collective Pitch Reduction

d. Approach

- [ ] Approach Angle
- [ ] Rate of Closure
- [ ] Ground Track
- [ ] Trim (±½ ball)

e. Approach Termination

- [ ] Heading (±5°)
- [ ] Touchdown
- [ ] Attitude
- [ ] Use of Collective

11. MAXIMUM PERFORMANCE TAKEOFF (40 kts or 100')

a. Prior to Takeoff

- [ ] Pre-Takeoff Check
- [ ] Determine Hover Power
- [ ] GO-NO GO Check

b. Takeoff

- ☐ Light on Skids
- ☐ Power Application (Smooth and Proper)
- ☐ Power Increase (2% UH-1H)
- ☐ Heading (±5°)
- ☐ Attitude (40 kts ±10 kts)
- ☐ Ground Track
- ☐ Trim (±½ ball)

12. STEEP APPROACH:

a. Prior to Entry

- ☐ Altitude (±50')
- ☐ Airspeed (60 kts ±5 kts)
- ☐ Ground Track

b. Approach Entry

- ☐ Entry Angle
- ☐ Collective Pitch Reduction

c. Approach

- [ ] Approach Angle
- [ ] Rate of Closure
- [ ] Ground Track
- [ ] Trim (±½ ball)

d. Approach Termination

- [ ] Heading (±5°)
- [ ] Touchdown
- [ ] Attitude
- [ ] Use of Collective Pitch

13. HOVERING AUTOROTATIONS:

- [ ] Heading (±5°)
- [ ] Drift
- [ ] Use of Collective Pitch
- [ ] Touchdown

14. HYDRAULICS OFF LANDING:

- [ ] Altitude (±100')
- [ ] Published Emergency Procedure
- [ ] Pre-Landing Check
- [ ] Approach Angle
- [ ] Rate of Closure
- [ ] Ground Track
- [ ] Touchdown
- [ ] Collective Braking
- [ ] Trim (±½ ball)

15. SIMULATED ANTI-TORQUE FAILURE (L = Left Pedal, R = Right Pedal)

a. Initially

L	R	
[ ]	[ ]	Throttle (Manual Control)
[ ]	[ ]	RPM Control (6400)
[ ]	[ ]	Ground Track
[ ]	[ ]	Altitude (±100')
[ ]	[ ]	Pre-Landing Check

b. Approach Entry

L	R	
☐	☐	Airspeed (60 kts ±5 kts)
☐	☐	Engine RPM (L.P. 6200, R.P. 6400)
☐	☐	Entry Angle
☐	☐	Collective Pitch Reduction

c. Approach

☐	☐	Approach Angle
☐	☐	Rate of Closure
☐	☐	Engine RPM (L.P. 6200, R.P. 6400)
☐	☐	Ground Track

d. Touchdown

☐	☐	Airspeed (at or above translational lift)
☐	☐	Lane Alignment
☐	☐	Touchdown
☐	☐	Collective Braking

16. STANDARD AUTOROTATION:

a. Entry

☐	Collective Pitch Full Down
☐	Trim
☐	Rotor RPM (in the green)
☐	Throttle (flight idle)

b. Descent

- [ ] Ground Track
- [ ] Glide Established (80 kts ±10 kts)
- [ ] Rotor RPM (in the green)
- [ ] Trim

c. Landing Approach

- [ ] Deceleration
- [ ] Collective Pitch (as required)
- [ ] Ground Track
- [ ] Trim

d. Touchdown

- [ ] Heading
- [ ] Attitude
- [ ] Collective Pitch (as required)

17. LOW LEVEL AUTOROTATION:

a. Entry

- [ ] Collective Pitch Full Down
- [ ] Trim
- [ ] Deceleration

b. Landing Approach

☐ Collective Pitch (as required)

☐ Ground Track

c. Touchdown

☐ Heading

☐ Attitude

☐ Collective Pitch (as required)

18. ACCELERATION & DECELERATION:

a. Entry

☐ Altitude (min 500' AGL)

☐ Airspeed (90 kts ±10 kts, roof mtd. pitot)

b. Deceleration

☐ Power Reduction (10 lbs ±1 lb)

☐ Pitch Attitude: Adjust to Maintain Altitude (±50')

☐ Trim (±½ ball)

☐ Heading (±10°)

☐ Airspeed (40 kts, -0 + 5kts)

c. Acceleration

- [ ] Power Increase (12 lbs ±1 lb)
- [ ] Pitch Attitude: Adjust to Maintain Altitude (±50')
- [ ] Trim (±½ ball)
- [ ] Heading (±10°)
- [ ] Airspeed (90 kts, ±10 kts)
- [ ] Power Reduction: As Required to Maintain Airspeed

19. CONFINED AREA OPERATIONS:

- [ ] High Reconnaissance
- [ ] Pre-Landing Check
- [ ] Low Reconnaissance
- [ ] Approach
- [ ] Touchdown
- [ ] Ground Reconnaissance
- [ ] Pre-Takeoff Check
- [ ] GO-NO GO Check
- [ ] Takeoff

20. PINNACLE OPERATIONS:

- [ ] High Reconnaissance
- [ ] Pre-Landing Check
- [ ] Low Reconnaissance
- [ ] Approach
- [ ] Touchdown
- [ ] Pre-Takeoff Check
- [ ] Takeoff

21. SLOPE OPERATIONS:

a. Descent to Touchdown (Upslope Skid)

- [ ] Descent (Vertical)
- [ ] Heading ($\pm 5^{\circ}$)
- [ ] Use of Collective

b. Descent to Touchdown (Downslope Skid)

- [ ] Heading
- [ ] Use of Collective
- [ ] Use of Cyclic

c. Takeoff

- ☐ Use of Cyclic
- ☐ Power Application
- ☐ Heading (±5°)
- ☐ Ascent (Vertical)

22. FORCED LANDING:

a. Entry

- ☐ Collective Pitch Full Down
- ☐ Trim (±½ ball)
- ☐ Rotor RPM (in the green)
- ☐ Glide Established
- ☐ Checked RPM/N_1/AS (called out)

b. Descent

- ☐ Selection of Landing Area
- ☐ Emergency Communication Procedures (if time permits)
- ☐ Airspeed (as required)
- ☐ Made the Field

c. Termination

- ☐ (1) Power Recovery
- ☐ (2) Climb

APPENDIX G

MISSION MODEL: PLAN, FILE
AND FLY AN IFR MISSION

1. Check weather:
   a. Can flight be made?
   b. Will it be IFR or VFR?
   c. If IFR, is an alternate required?

2. Plan flight:
   a. Check NOTAMS
   b. Determine that all required publications, charts, approach plates, computers, etc., are available to the pilot
   c. Determine data and fill in the flight log
   d. Fill in flight plan (175)
   e. Get weather briefing (175-1)
   f. File 175 and 175-1

3. Preflight, start, and run-up
   a. Check aircraft status. Forms 2408-12 and -13
      (1) Note discrepancies
      (2) Refueling accomplished and recorded
      (3) Due date of next periodic (is sufficient time available to allow completion of flight?)
      (4) Is the aircraft flyable? Do the forms indicate that all systems (radio, navigation equipment, etc.) required for successful completion of this flight are available and functioning normally?
      (5) Make the appropriate entries in Form 2408-12
   b. Exterior check (use checklist)
   c. Interior check (use checklist)
   d. Before start check (use checklist)
   e. Start (use checklist)
   f. Engine run-up (use checklist)
   g. Engine health check

4. Prepare to hover
   a. Tune and copy Automatic Terminal Information Service (ATIS) if available
   b. Contact Ground Control
      (1) Taxi clearance
      (2) Time
      (3) Active runway
      (4) Altimeter setting
      (5) Clearance delivery instructions
   c. Contact Clearance Delivery
      (1) Copy clearance
      (2) Read back
      (3) Set navigation radios as desired

(4) Set communication radios as desired
(5) Set course selector as desired
(6) Set transponder as desired

5. Hover to takeoff area:
   a. Raise the helicopter to a hover
   b. Initiate air taxi
   c. Perform "prior to instrument takeoff" check (use checklist)
   d. Land at takeoff area

6. At takeoff area:
   a. Contact the tower for takeoff clearance
   b. Move to the takeoff position
   c. Perform "before takeoff" check (use checklist)

7. Instrument takeoff
   a. Power
   b. Trim
   c. Attitude
   d. Airspeed

8. At climb airspeed
   a. Establish climb
      (1) Power
      (2) Trim
      (3) Attitude
      (4) Airspeed
   b. Report airborne
   c. Make other required reports
   d. Follow other instructions, if any (transponder, radio contact, reports, etc.)

9. At assigned altitude (establish cruise altitude)
   a. Power
   b. Trim
   c. Attitude
   d. Airspeed
   e. Check engine instruments for normal indications

10. First leg of flight
   a. Intercept and maintain course
   b. Prepare to compute fuel consumption
      (1) Record time
      (2) Record amount of remaining fuel
   *c. Maintain altitude
   *d. Maintain airspeed
   e. Prepare to verify ETA (as soon as possible)

---

*These duties are performed on all legs.

(1) Record time at known location
(2) Record time at second known location
(3) Determine distance between two locations
(4) Compute ground speed

*f. Revise ETA if necessary

g. Compute fuel consumption
(1) Hasty check at 10 minutes
(2) Normal check after minimum of 15 minutes

*h. Monitor engine instruments

*i. Remain alert for unusual sounds or vibrations

*j. Maintain communications

*k. Monitor weather broadcast for changes in enroute weather

*l. Monitor enroute weather for unforecast conditions

*m. Report any unforecast weather conditions encountered to controlling agency (Center, Flight Service Station, Approach Control, etc.)

11. Approaching checkpoint
a. Prepare to identify checkpoint
b. Prepare report, if required
c. Prepare for required changes in flight
(1) Heading
(2) Altitude
(3) Holding
(4) Navigation procedures
d. Make frequency changes, if required

12. Over checkpoint
a. Record time
b. Turn to intercept new course, if required
c. Verify ETA
d. Update ground speed, if necessary
e. Make any required changes in report
f. Tune radios, if necessary
g. Make report, if required

13. Second, and succeeding flight legs
a. Intercept and maintain new course
b. Update flight log
c. Continue with those duties marked with an asterisk on first flight leg
d. Verify ground speed
e. Monitor fuel consumption

14. Approaching destination
a. Turn controls over to copilot
b. Study approach plate
(1) Minimums for available approach(es)

---

*These duties are performed on all legs.

(2) Transitions to final approach fix
(3) Field elevation
(4) Procedure turn (if applicable)
(a) Type
(b) Altitude
(c) Outbound heading
(d) Inbound heading
(5) Radio frequency: UHF-VHF
(a) Approach Control
(b) Tower
(c) Ground
(6) Missed approach procedures
(7) Minimum sector altitudes
(8) Time from final fix to field boundary

c. Brief copilot
(1) Make appropriate radio calls
(2) Information relative to approach
(3) Pre-landing check
(4) Notify pilot when ground is sighted

d. Take control from copilot

e. Tune radios

15. Over destination (approach: VOR, ADF, GCA, ILS)

a. Time

b. Turn

c. Report

d. Begin approach
(1) Time outbound leg
(2) Descend to procedure turn altitude, if applicable
(3) Make procedure turn
(4) Turn inbound on final
(5) Descend to final approach fix altitude
(6) Before landing check
(7) Final approach fix
(a) Check time
(b) Report
(c) Descend to minimums
(d) Time to field boundary
(e) Report VFR to tower
(f) Land
(g) Taxi to tie-down area
(h) Close flight plan
(i) Make appropriate entries in Forms 2408-12 and -13
(j) Secure aircraft

APPENDIX H

OUTINE OF 2C35 TRAINING PERIODS

First Period

1. The student copilot (SCP) will read each checklist CHALLENGE part of the item (all before the dash), hesitate, then read the RESPONSE. The instructor pilot (IP) should locate the item for the student pilot (SP). The SP should touch the item, indicating to the instructor that he has located it, repeat the CHALLENGE, perform the function, then repeat the RESPONSE, e.g.:

SCP: "Hydraulic Control Switch - ON"

IP: Locates hydraulic control switch for SP

SP: Places his hand on the hydraulic control switch, checks that the switch is in the ON position, then responds "Hydraulic Control Switch - ON."

This procedure is followed until the student demonstrates that he knows the location of all controls.

2. Students will perform all items on the following checks: (NOTE: the pattern and sequencing of the check prior to the student's first performance should be discussed. The IP will also explain the purpose of each check as noted.)

a. Prestart. Purpose: to insure that the pilot and copilot are properly seated and secured, and that applicable aircraft system controls are in the proper operating mode prior to starting the engines.

b. Starting engine. Purpose: provides a safe, standardized procedure for starting the aircraft engine.

c. Engine run-up. Purpose: to determine that the aircraft engine and applicable systems are operating normally.

d. Pre-takeoff. Purpose: a final check, made just prior to takeoff, to insure that the aircraft engine and applicable systems are operating normally as required for flight.

e. Engine shutdown. Purpose: provides a safe, standardized procedure for stopping the engine, placing applicable systems in the appropriate inoperative status, and securing the aircraft after operation.

3. Repeat Items 2a. - 2e. with second SP.

4. Explain Forms 2408-12 and -13 to the students and have them make appropriate entries.

5. Debrief students.

6. Make study assignments for Period 2: -10 checklist and programed texts.

Second Period

1. Brief students: designate who will act as SP for first trial and what will be covered during the period; check Form 2408-13 for aircraft status and make appropriate entries on Form 2408-12.

2. Proceed through the checklist items as in Period 1.

3. Introduce systems information for the following checklist items:

Checklist Number	Comment
	BEFORE STARTING ENGINE
6	Function of the cyclic, collective, and pedals
19	Difference between IN and OUT. When to place in OUT position; what capabilities are available in terms of Free Gyro or turn indicator use
20	Review instrument panel clusters
25	How to set with screwdriver
26	Purpose of two positions and #1 and #2 pointers
27	Set to field elevation; when engine is started may change. Leave alone; will indicate properly in the air
30	Start - generator serves two functions. Standby generator - engine driven, starter battery or APU powered. Start position S/G acts as starter to start aircraft.
32	Important that battery provides maximum voltage for starting. Precludes hot start due to low turbine RPM.

Checklist Number	Comment
35-44	To prevent drain on battery. Explain primary and secondary lights. Cabin heat switches--explain if engine temperature surges turn bleed air OFF
	STARTING ENGINE
1	Provide power to crank the starter if battery start; otherwise APU does this
11	Positions solenoid to minimum setting
16	Battery start check minimum 14 volts. T-13 engine goes to 40% in approximately 20-25 seconds. Demonstrate hot and hung start.
19	Hold in caged position until the inverter switch is in SPARE (prevents damage to the instrument, caused when instrument erects and stops are hit).
20	Which instruments are lost when inverter fails: AC Failure Relay Fuel Quantity Indicator Attitude Indicators AN/ASN 43 (Gyro Mag Compass) Transponder Course Indicator Torque Pressure Transmission Oil Pressure Engine Oil Pressure Fuel Pressure (remains at last position until driven to "0")
	ENGINE RUN-UP
1	Purpose of the switch and how to check
2	What hydraulic boost does for controls, necessity for doing check the way it is done
	How fuel pressure system works. One or two electrically driven fuel pumps, one in each tank, one engine-driven. Engine-driven will not supply sufficient pressure to keep engine running above 4600 feet pressure altitude.

Checklist Number	Comment
7-9	Check is to determine that each inverter is supplying appropriate AC voltage (115V) to each phase of the three-phase 115V AC electrical system
10-15	This check is to determine that in the event of main generator failure, the standby generator picks up the load as it should. In addition, the non-essential bus switch is functioning
22	How to synchronize the compass with the sensing element
23	Mag compass is the master compass
24	Purpose of the altimeter setting
25	Purpose of pitch and roll knobs
	ENGINE SHUTDOWN
2	Why this is done
6	Hot shutdown (must be in start position to motor engine

4. Debrief students.

5. Make entries in 2408-12 and -13.

6. Give study assignments.

Third Period

1. Brief students: Designate SP and SCP and what will be covered during the period; check 2408-12 and -13 and make entries.

2. Proceed through checklist items using the -10 checklist. SCP will challenge only, and SP will answer with response after he has performed the task. In order that the IP will know that he is checking the appropriate switch, instruments, knobs, etc., the SP will touch or point it out to the IP as he makes the response. If SP does not respond properly, and it becomes apparent he does not know what to do, SCP will tutor him as to the appropriate action to take. If SCP does not know, IP will explain. IP will record errors on form provided.

3. Practice hot start and hung start.

4. Demonstrate the following new emergency procedures:
   Low battery
   Low oil pressure
   N_2 governor failure, high and low side

5. Debrief students.

6. Make entries in 2408-12 and -13.

7. Give study assignments.

Subsequent Periods

Practice the above until students can make the appropriate response to starting and run-up malfunctions and accomplish the pre-start, start, run-up, and shutdown procedures with one error-free performance.

Debrief and make study assignment for first period in 2B24.

APPENDIX I

2B24 TRAINING PERIODS

For early training periods, the following outline has been developed. During these periods, the SP will occupy the pilot seat, the IP the co-pilot seat, and the SCP the instructor's seat. Employment of the freeze capability should be particularly noted.

1. Initial Conditions:
   Altitude: 3000'
   Airspeed: 80 KTS
   Heading: 360°
   Control parameters: Everything frozen
   Motion: On

2. Heading (roll control)
   a. Attitude indicator
      Explain: Sky representation
      Ground representation
      Horizon representation
      Roll trim knob
      Pitch trim knob
      Bank indices
   b. Cyclic control (unfreeze lateral parameter only)
      Explain relationship between bank indices and lateral movement of the cyclic control.
      Allow student to practice establishing various angles of bank (selected by the IP) to acquaint him with
   c. Radio magnetic indicator (RMI) heading indicator (unfreeze)
      Explain purpose and operation.
      Explain relationship between heading, bank angle, and lateral cyclic control.
      Have student turn to selected headings, right and left, using 7° and 14° angles of bank. Point out differences in rate of turn, and that headings increase in right turns and decrease in left turns. Use heading bug. Student practices maintaining heading.

3. Turns
   a. Standard rate
      Explain: Turn needle (unfreeze)
      Purpose
      Relationship between cyclic control and turn needle
      How to establish a standard rate turn:
      (1) Establish 14° angle of bank on attitude indicator
      (2) Make fine adjustments with turn needle
      Relationship between bank angle and airspeed
      Have student practice making standard rate turns right and left.

b. Half standard rate
Explain rate of turn, when used (20^{o} or less heading change).
Have student practice half standard rate turns right and left.

Have student practice turns. IP selects heading. Select some headings 20^{o} or less to give sutdent practice in determining when to make half standard rate turns.

4. Pitch control (unfreeze fore and aft control only)
Explain the relationship between fore and aft movement of the cyclic control and the vertical movement of the aircraft symbol on the attitude indicator.
Have student practice making attitude changes of 1, 2, and one-half bar widths.
Explain the relationship between pitch attitude and airspeed (pitch controls airspeed).
Have student practice maintaining and changing airspeed (disregard altitude).
Explain the relationship between pitch attitude: changes, airspeed, and altitude.
Have student practice making small altitude changes (less than 100', or speed changes of 10 KTS or less) with pitch changes.
Unfreeze lateral control and have student practice making turns to selected headings while maintaining airspeed (point out altitude loss). Next, have him make some turns and maintain altitude with pitch (point out airspeed loss).

5. Power control (unfreeze collective, freeze cyclic control)
Explain: Relationship between power, airspeed, and altitude
Power controlled by collective pitch control
Power is referred to as "torque"
Unit measurement of torque is "pound"
Amount of torque being used is indicated on the Torque Meter
One pound of torque equals two knots or 100 FPM rate of altitude change (approximately)
Have student practice making power changes and, to familiarize him with the Torque Meter and its location, have him call out the indications on the Torque Meter.

Unfreeze pitch control and have the student practice making airspeed changes while maintaining constant altitude, and altitude changes while maintaining constant airspeed. Stress: pitch for airspeed; power for altitude.
Explain use of power in turns.

6. Trim (ball centered--longitudinal axis and line of flight parallel)
Explain: Relationship between power and ball
Pedals control ball position
Power and heading
Have student practice making power changes while keeping the ball centered with the pedals. Cross-check heading.

7. Force trim button
   Student should remember system information learned in the 2C35. Explain practical use in the 2B24 and insure that the student understands and practices using the force trim button. Once he understands the principles, its use is optional.

At this point in his training, the student should be able to demonstrate the following knowledges and skills:

Knowledges.

Verbalize the functioning of:

- Cyclic control
- Collective pitch control
- Pedals
- Force trim button

Define the following:

- Pitch
- Roll
- Yaw
- Trim
- Heading
- Altitude
- Airspeed
- Torque
- Attitude
- Standard rate turn
- Vertical velocity
- Standard rate climb
- Standard rate descent
- Bank
- Ball
- Nose
- Needle
- Force trim
- Pounds
- Bar

Skills.

Respond, with appropriate control movement, to the following verbal cues:

- Raise the nose one bar high
- Lower the nose one bar low
- Establish 15^{o} right bank
- Establish 15^{o} left bank
- With pedals, move the ball right
- With pedals, move the ball left
- Increase power five pounds
- Decrease power five pounds
- Trim cyclic to right with force trim
- Trim in right pedal with force trim

The student will have had no flight training previous to flying the 2B24. In order to achieve the skills needed for mission-concept flight training, he will first need to develop the skills necessary to coordinate all the controls required for minimum aircraft control. Toward this end, some practice flying of the following control coordination exercises will be necessary:

Maintaining heading and altitude
Changing airspeed
Changing heading, standard and half standard rate
Changing altitude, standard rate
Changing heading and altitude
Instrument takeoff
Ground controlled approach ASR-PAR
Unusual attitude recovery

It is not necessary that the student learn to perform these exercises to a high degree of proficiency. However, he should develop sufficient knowledge and skill to enable him to perform the flight control functions necessary to maintain reasonable control of the attitude of the aircraft while learning advanced navigation, radio, and approach procedures. His proficiency in aircraft control will improve as a result of the flying practice obtained learning advanced procedures.*

At this point, each training period should follow the Course Outline in Appendix B, and, where appropriate, Maneuver Performance Record Forms (MPRFs) will be used to control the amount of practice provided for each maneuver and to provide detailed and systematic feedback to the students. The information recorded on the MPRFs will also provide data which, when submitted to statistical analysis, will provide information to help evaluate the program. In addition to those covering the control coordination exercises, MPRFs will also be used to score student performance on advanced navigation, approaches, and selected emergency procedures. Throughout this training, all relevant communications and reporting procedures will be practiced by each student in accordance with all simulator training tasks.

When the student has met appropriate MPRF criteria, he should be introduced to VOR orientation, track interception, and tracking. At this time, the mission training concept can be employed in simple terms. To introduce the student to VOR orientation, the task should be made into a problem such as : "Locate the aircraft in relation to the Dothan VOR. Determine the radial the aircraft is on, track to the station on that radial, and proceed to Marianna VOR on V-__." This is a simple mission, and the student can be worked through it by a process of verbalization,

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*Specific performance criteria cannot be specified in detail until the program described here can be tested using an appropriate student population.

discussion, and practice. As an aid, it should be remembered that the device can be frozen at any time while a point is explained and a relaxed discussion takes place.

As the student progresses, the mission can be expanded. Additional tasks, reporting, holding, an occasional emergency, computing ETAs and fuel consumption, etc., can be added. Early in the program, preparation of flight plans must begin.